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EVERYDAY ARITHMETIC

ADVANCED

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EVERYDAY ARITHMETIC

Revised Edition

ADVANCED BOOK

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FOREWORD

AND

BRIEF SUGGESTIONS TO TEACHERS

THIS book is intended for use in the seventh and eighth grades. Continuing the plan of the series, its chief aim is to give pupils power to use number efficiently, as it occurs in everyday life. The preceding books have laid emphasis on home and school interests; this book reaches out into the world of business, industry, and civic affairs.

Under the dominant aim of mental discipline, which fastened itself upon the teaching of arithmetic many years ago, our instruction in this subject has, until recently, lagged sadly behind that in other subjects. Although the doctrine of mental discipline has professedly been abandoned by all enlightened teachers, our textbooks have not yet loosened the shackles of this formalistic view of the subject. The teaching of antiquated arithmetical processes has persisted in them, despite the fact that insufficient attention has been given to practice in the essential processes and that there is an increasing number of modern practical applications demanding attention. But, notwithstanding the inadequacy of former textbooks, progressive teachers, while seeking to conserve all that is socially valuable in the arithmetic taught under the old ideals, have shown themselves ready for a more vital kind of teaching.

The authors of the Everyday Arithmetic have attempted to write the books in this series from this new point of view. It has been assumed that every pupil needs a thorough foundation in all the essential processes, which, fortunately, are few in number, and which, when rightly taught, can be mastered by all pupils. Books One and Two of this series have given special attention to this attainment of arithmetical skill. In this book, exercises are introduced to make pupils conscious of their need of accuracy and skill in these processes and to lead them to ferret out and overcome any weaknesses that may still exist in their arithmetical training.

The main emphasis in this book is laid upon the application of the essential processes to studies of practical value. In selecting these studies, the social needs common to the majority of pupils have been considered. The studies chosen are such as will not only make pupils efficient in solving real problems, but also arouse their interest in the business and industrial world and in economic questions. The experience of our most effective teachers has demonstrated that this kind of arithmetic work is more interesting to pupils, commands their coöperation and earnest endeavor to a greater extent, and bears larger fruit in adapting pupils to their future careers than does the formal kind of arithmetic that has largely prevailed in the past.

The authors wish to express their appreciation to the large number of business men, teachers, and other professional men who, in the preparation of these books, have made suggestions, contributed material, or given assistance in reading the manuscript or proof. In particular they wish to thank Professor Walter F. Dearborn, of the Department of Education, Harvard University; Dr. A. S. Dewing, of the Department of Economics and of the Business School, Harvard University; Mr. Olaf Olson, Vice-President of the First National Bank, Boston; Mr. Harry F. Payne, of the American Bank Note Company; Mr. William Mulholland, Chief Engineer, Department of Public Service, Los Angeles, California; various officials of the Post Office, Boston, Massachusetts; members of the staff of the Collector of Internal Revenue, Boston; the Baldwin Locomotive Works; the Blake and Knowles Steam Pump Company; Munn and Co. Incorporated; the Pierce-Arrow Motor Car Company; and the Jordan Marsh Company; also Miss Alice J. Hill, of the Indianapolis Public Schools; Miss Mary Reid, supervisor of training at the Gorham, Maine, Normal School; and the following members of the faculty of the State Normal School, Salem, Massachusetts: Mr. C. S. Goldsmith, teacher of manual training; Miss Amalie Knobel, Miss Mary Perham, and Miss Mary E. James, supervising teachers in the training school.

BRIEF SUGGESTIONS TO TEACHERS

Do not require set forms for either the solution or the explanation of problems. Insist only on clear, direct methods, accuracy of statement and result, and neatness and legibility in written work.

Train pupils to express all their answers in businesslike forms. It is customary in business transactions to express answers in dollars and cents to the nearest cent — five mills or over is called another cent; less than five mills is discarded; other decimals may generally be approximated in the same way in the third decimal place. Some answers — averages, per capita distributions, etc. — of course require more exact fractions.

Especially in these grades, pupils should be trained to an increasing independence of the pencil in solving problems. Encourage them to solve "mentally" as many problems as possible, and to take "short cuts" in their written work whenever they see the opportunity.

Establish in the mind of every pupil before he leaves school the standards of accuracy and efficiency that are required in the business and industrial world.

For pupils who are below the required standard in computing, it will be found profitable to set aside one or two five-minute periods a day for practice. A pupil who finds it necessary to repeat an exercise a number of times should be encouraged to keep his record in a graph. (See exercise, page 2; also, footnotes, page 37.)

Topics and problems of the greatest value to the majority of pupils have been selected for these books; but, obviously, some of the material will be of less value to pupils in a given school than to pupils in a different environment, even in the same locality. Teachers should omit topics or problems, both required and optional, that have relatively little value for their pupils.

In accordance with the suggestion given frequently in this book, encourage pupils to bring in business forms and data; — for instance, in studying the cost of the fire department (see page 214) taken up in connection with taxation, have pupils visit the nearest fire department station and obtain information as to the work of that station and the cost of maintaining it. In making these community investigations, pupils may make individual trips or go in groups. The latter method is usually to be preferred.

In getting the standing of pupils for reports and promotions, the tests in the books may be varied by changing the numbers slightly. Also, in ranking pupils, the starred problems should be taken into consideration. Those pupils, who are able to do such optional exercises, should receive due credit for the work.

PART FIVE

CHAPTER I. THE FUNDAMENTAL PROCESSES

1. Accuracy in Computing

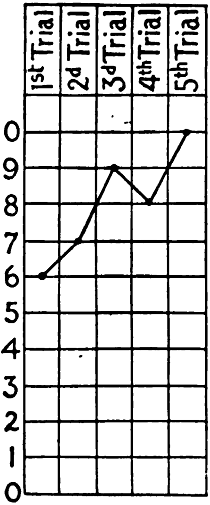
In every trade and business, and in most professions, accuracy in the use of numbers is required. Carpenters and machinists must be accurate in measuring. Merchants, bankers, and their employees must be accurate in all money transactions. Doctors, lawyers, scientists, and other professional men must be able to make accurate computations with scientific and other data.

To meet the need for computing in everyday transactions and to prepare for future work, every boy and girl should learn to be accurate in the use of number.

In attaining this useful habit, it will be found helpful: (1) To write figures neatly in straight columns and rows; (2) to compute rapidly but at the same time carefully; (3) to test all answers.

Much of the computing of everyday life is done without a pencil. Every one finds it convenient to verify mentally the total of a bill, the amount of change due, and other computations. Try to attain accuracy in all your arithmetic work.

2. Keeping a Record in a Graph



Record in Addition

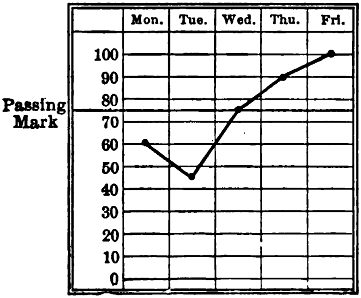
A boy's record on a set of problems in addition was: First trial, 6 out of the 10 problems required correctly solved within a given time; second trial, 7 out of the 10; third trial, 9; fourth trial, 8; fifth trial, 10. This record is pictured in this diagram.

Such a diagram is called a graph. It shows at a glance the progress that the boy made on the set of problems.

The second graph given here shows a week's problem record in per cents. For Monday the record was 60%; for Tuesday, 45%; for Wednesday, 75%; for Thursday, 90%; for Friday, 100%.

In making a graph, rule paper with a pencil, or use squared paper, which is easily obtained. Place the dots in the proper places, then connect them with straight lines.

1. From the following record make a graph similar to the one shown above: First trial on a set of problems in division; 4 problems correctly solved out of the 8 required within the time limit; second trial, 6 out of the 8; third trial, 5; fourth trial, 7; fifth trial, 8.



A Week's Record

2. Make a graph like the second one pictured here. Use this attendance record of a seventh-grade class: Monday, 88%; Tuesday, 90%; Wednesday, 80%; Thursday, 92%; Friday, 96%.

3. Use a graph to show your progress with Lessons 3, 6, and 7.

3. Rapid Addition and Subtraction

I

The following tests contain the number facts that are most likely to give trouble in addition and subtraction. Practice on each test until you can get the correct answers within the time limit. Compute with only a few words in mind. In adding 8, 4, 6, say *12, 18*, or merely *18*. In taking 8 from 17, say *9*, not *8 from 17 is 9*.[1]

[Write answers on the folds of a paper.[2]]

Test No. 1. Add. Time limit, 1¼ minutes for 30 problems.

1.	6	9	6	6	9	6	4	7	8	7
	4	4	6	7	8	9	5	6	8	9
	8	6	5	8	5	7	9	6	6	8
2.	7	6	8	7	5	8	5	7	9	5
	0	5	6	7	8	9	4	5	6	7
	5	7	7	5	7	9	9	8	8	9
3.	5	9	8	8	7	8	6	6	9	7
	8	9	4	5	6	7	8	9	7	8
	8	7	5	9	9	5	9	8	6	9

Test No. 2. Subtract. Time limit, ¾ minutes for 30 problems.

1.	13	11	12	15	16	11	12	15	17	13
	9	6	8	9	7	4	7	8	9	5
2.	14	12	11	14	13	16	11	12	13	16
	5	6	5	9	6	8	7	4	7	9
3.	17	8	15	14	12	14	13	14	15	18
	8	0	6	8	5	6	8	7	7	9

---

[1] For those pupils who are below the standard, it will be found helpful to set aside one or two five-minute periods a day for practice. In the teacher's record, credit should be given a pupil as soon as he meets the standard in a test.

[2] To save copying problems, answers may be written on the folds of a sheet of paper placed below problems. Folds an inch wide may be turned back for each row.

If, in these tests, you fail to get the correct answers within the time limit, use for practice the exercise having the same number, then try the test again.

[Write answers on the folds of a paper.]

Test No. 3. Add. Time limit, 1¼ minutes for 3 problems.

4	3	5
3	1	4
7	4	4
6	5	2
8	7	5
9	0	4
7	6	7
4	9	0
5	8	6
4	7	5
3	0	8
4	8	9

Practice No. 3. Practice until you can add each column at a steady rate.

1.			2.			3.		
7	6	4	5	2	8	9	7	7
2	3	4	5	4	4	3	8	4
1	9	3	4	7	3	8	9	3
4	4	2	6	5	8	4	6	6
5	8	5	7	4	9	8	5	5
5	6	7	6	8	4	6	8	6
4	7	6	0	4	7	9	4	8
0	3	8	4	9	5	5	3	4
6	4	0	5	5	7	2	2	6
5	3	9	0	4	7	3	7	1
9	8	8	8	5	0	5	9	8
6	7	8	9	8	6	9	8	7

Test No. 4. Subtract. Time limit, 1½ minutes for 5 problems.

65645	163736	97367	30000	407040
29274	87240	3458	12354	23160

Practice No. 4. Subtract, naming differences only

1.	2.	3.	4.	5.
76354	132577	46559	50000	804030
41268	65480	5484	13647	92940

6.	7.	8.	9.	10.
82758	111675	19246	60000	403000
29473	42590	4937	15232	31880

11.	12.	13.	14.	15.
65482	153624	35285	70000	708060
23936	78390	4778	43939	77390

16.	17.	18.	19.	20.
94378	142949	68748	90000	608070
38191	94560	5691	29391	27410

[Write answers on the folds of a paper.]

Test No. 5. Add. Time limit, 5 minutes for 6 problems.

769	848	965	746	785	957
559	456	774	886	578	362
332	738	435	974	764	695
787	866	758	195	596	284
483	586	994	859	689	787
446	856	258	544	465	485
867	724	446	290	160	196
634	547	729	859	958	140
847	345	859	586	675	798

Practice No. 5. Add rapidly but carefully.

1.	2.	3.	4.	5.	6.
632	639	632	545	869	323
674	235	255	594	649	553
884	578	295	829	684	865
546	592	566	757	866	472
643	534	462	578	367	442
440	797	959	766	945	535
562	647	748	645	587	758

7.	8.	9.	10.	11.	12.
723	947	665	957	865	996
769	848	965	746	785	957
559	456	774	886	578	667
332	738	435	974	764	695
787	866	758	895	596	784
483	586	994	859	689	787
446	856	858	544	465	485
867	724	446	699	668	796
634	547	729	859	958	987

II

[With pencil.]

1. The table on the next page gives for a year the expenses of five of the recreation parks in one of our large cities. Find the total expense for each item. For each park. For the five parks.

2. After paying the expenses, how much was left of $38,000 provided by the city for the support of these parks?

	Happy Hollow	Sherwood	Chestnut Street Pier	Disston Playground	Starr Garden	Total
Coal	$322.90	$344.50	$33.75	$279.60	$449.73	....
House cleaning supplies	13.73	118.89	20.79	18.35	28.46	....
Playground supplies	232.62	284.11	114.87	94.46	177.15	....
Electric light	726.63	527.08	....	252.80	519.06	....
Supplies	177.73	222.60	30.46	50.29	207.41	....
Repairs	143.63	89.11	245.50	88.25	535.26	....
Playground apparatus	273.40	....	151.05	13.00	341.84	....
Salaries	5,367.85	5,220.72	5,107.71	1,193.84	8,682.68	....
Entertainment	24.50	....	....	....	81.00	....
Planting trees, etc.	....	1,116.00	....	....	282.00	....
Towels	52.50	118.12	....	52.50	91.88	....
Bathing suits	....	495.00	....	....	....	....
Miscellaneous	47.26	72.13	19.31	73.35	192.31	....
Total	....	....	....	....	....	....

4. Estimating Answers in Addition and Subtraction

[Without pencil.]

1. Express as a round number: 7999; 49,978; 75,011.

2. Use round numbers and find the approximate sum of 4999 and 3989. Of $24.95 and $19.92.

3. What is the approximate difference between 1998 and 2500? Between $51.88 and $39.94?

One means of securing accuracy in computing is to form the habit of testing answers by comparing them with approximate ones. In solving each of the following problems, first find an approximate answer without the use of a pencil. Write this answer, then solve the problem and compare the two answers.

[With pencil.]

4. Five hundred dollars is spent in equipping a printing-room for a school. The press costs $266; the cases for type, $30; the case stands, $45; the composing table, $40. Find the cost of these articles.

5. For type, the school spends $30.40 for 40 lb. of 10-point century expanded, $15.20 for 20 lb. of 10-point century bold-face, and $17.75 for other kinds of type. How much is spent for type?

6. After paying for the press, type cases, case stands, composing table, and type, how much of the $500.00 is left for other expenses?

7. A seventh-grade class print during a year three numbers of a school paper. From the sale of the paper, they receive for the fall issue, $9.75; for the winter issue, $10.90; for the spring issue, $12.15. From advertisements, they receive a total of $9.80. For illustrations for the three numbers, the class spends $7.00; for paper, $2.88; for incidentals, $2.94. How much money is cleared?

8. Find the net profit from the following enterprise: A boy on a farm rents from his father $1\frac{1}{4}$ acres of land, on which he raises corn and potatoes. The corn he sells for $39.58; the potatoes, for $28.40. The boy pays his father for rent, seed, and fertilizer, and for the use of a horse, a total of $22.50. His time spent in raising the crops, he values at $11.25.

5. Speed and Accuracy in Multiplication and Division

I

If you fail to get the correct answer to a problem in one of these tests, use for practice the set below having the same letter.[1]

[With pencil.]

Test No. 6. Multiply. Time limit, after copying, $3\frac{1}{4}$ minutes.

A. $\begin{array}{r}2347\\ \underline{9}\end{array}$ B. $\begin{array}{r}1658\\ \underline{37}\end{array}$ C. $\begin{array}{r}4239\\ \underline{4020}\end{array}$ D. $\begin{array}{r}7906\\ \underline{178}\end{array}$

Test No. 7. Divide. Time limit, after copying, $5\frac{1}{2}$ minutes.

E. $7\overline{)6547}$ F. $81\overline{)48926}$ G. $68\overline{)36925}$ H. $159\overline{)75207}$

Practice. Find products and quotients:

[With pencil.]

A. 1 min.
1. 2346 × 3.
2. 7069 × 4.
3. 2968 × 7.
4. 5390 × 6.
5. 6207 × 8.
6. 6398 × 9.

B. $3\frac{1}{2}$ min.
1. 4231 × 24.
2. 7162 × 61.
3. 2349 × 47.
4. 1587 × 85.

C. 4 min.
1. 5231 × 201.
2. 6472 × 340.
3. 1758 × 6050.
4. 4269 × 7020.

D. $6\frac{1}{2}$ min.
1. 1308 × 642.
2. 3250 × 725.
3. 5809 × 139.
4. 4290 × 283.
5. 6070 × 684.

E. 2 min.
1. 74562 ÷ 3.
2. 51582 ÷ 4.
3. 24290 ÷ 6.
4. 76344 ÷ 5.
5. 63490 ÷ 7.
6. 52359 ÷ 9.
7. 57884 ÷ 8.

F. 5 min.
1. 8821 ÷ 42.
2. 44226 ÷ 63.
3. 23041 ÷ 72.
4. 59304 ÷ 84.
5. 73257 ÷ 91.

G. 8 min.
1. 36654 ÷ 57.
2. 36358 ÷ 49.
3. 64679 ÷ 76.
4. 67068 ÷ 69.
5. 56814 ÷ 87.

H. 12 min.
1. 108528 ÷ 272.
2. 393625 ÷ 495.
3. 119875 ÷ 175.
4. 337536 ÷ 879.
5. 94956 ÷ 164.

---

[1] Pupils failing to complete a test within the time limit, should practice on the types of problems that delay them.

II

A man earning $117 a month (26 days) should receive how much pay for 14 days' work?

In estimating the amount of pay, 14 days may be thought of as 1 day over a half of 26 days, and the amount due as about $4.00 over a half of $117, or approximately $62.50.

ESTIMATE: $62.50.

SOLUTION: Am't due for 1 da. = $\frac{1}{26}$ of $117, or $4.50.
Am't due for 14 da. = $4.50 × 14, or $63.00.

[With pencil.]

First estimate the answer, then write out the solution for each problem:

1. For the seventh- and eighth-grade classes in a school, 35 geographies are bought at $1.40, 70 histories at $1.00, and 70 supplementary readers at $.55. The total membership of the two classes is 70. The average expense per pupil for new books is how much?

2. A year's expense for a family of 6 amounts to $595.40 for food, $400.00 for rent, $198.00 for clothes, and $310.50 for other expenses. The average expense for each person is how much for the year? For each month?

3. A young man, earning $28.00 a week, pays each week $7.25 for board, $2.75 for room rent, 65¢ for laundry, $1.20 for carfare, and 95¢ for incidentals. After paying these expenses, and $95.00 for clothes, how much money should he have left at the end of a year?

4. Improvements on a lawn require for 6 days the labor of 4 men at $4.50 a day, and that of an overseer at $8.10 a day. Find the cost.

5. In building a house, a contractor orders 14,900 bricks at $18 per thousand and 14 barrels of cement at $3.04 a barrel. Find the amount of his bill.

*6. A farmer plants in one year 91 acres of wheat. The yield is 17 bu. to the acre; the cost of raising the crop is $21 an acre; the selling price of the wheat, $1.80 a bushel. The next year, he plants 95 acres. The yield this year is 16 bu. to the acre; the cost of raising the crop is $24 an acre; the selling price of the wheat, $2.20 a bushel. Find the difference in the net profit per acre for the two years; also, the difference in the total net profit.[1]

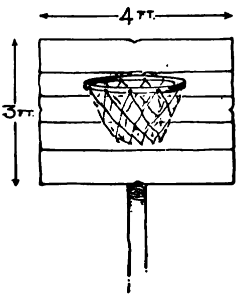
6. Practice in Computing with Fractions

I

[Use pencil only when needed.]

1. A line $1\frac{7}{8}$ inches in length is extended $1\frac{3}{8}$ inches. How long is the extended line?

2. A board $1\frac{3}{4}$ inches thick is planed down $\frac{1}{8}$ of an inch on one side and $\frac{8}{16}$ of an inch on the opposite side. What is the thickness of the board after planing?



3. A guard 3 ft. by 4 ft. is to be made for a basket-ball goal. Boards 4 ft. long are nailed lengthwise across the guard. The first board is $8\frac{1}{2}$ in. wide; the second board, $5\frac{3}{4}$ in. wide; the third board, $6\frac{1}{2}$ in. wide; the fourth, $7\frac{1}{4}$ in. wide. Find the required width for the fifth and last board.

4. Find the width of the last board, if the widths of the others are, respectively, $6\frac{3}{4}$ in., $7\frac{1}{2}$ in., $8\frac{1}{4}$ in., and $6\frac{3}{8}$ in.

5. From a bolt of cloth containing $40\frac{3}{4}$ yd., the following amounts are cut: $8\frac{1}{2}$ yd., $12\frac{2}{3}$ yd., $4\frac{3}{8}$ yd. How many yards are left?

6. Find the amount left from 75 yd. of matting after the following lengths have been cut: $10\frac{1}{3}$ yd., $14\frac{1}{8}$ yd., $15\frac{1}{2}$ yd., $18\frac{7}{8}$ yd.

7. Add $60\frac{5}{6}$, $40\frac{2}{5}$, and $12\frac{1}{2}$. From this sum, subtract $75\frac{2}{3}$.

8. A child in an open-air class who weighed $80\frac{3}{4}$ lb. gained $2\frac{1}{2}$ lb. the first month and $1\frac{5}{8}$ lb. the second month. How much did he then weigh?

---

[1] All problems starred are intended as optional work.

II

If you fail to get the right answer to a problem in a test, practice solving problems in the set below having the same letter, then try the problem again.

Test No. 8. [With pencil.]

A. $12\frac{7}{8} + 4\frac{5}{8} = ?$ B. $8\frac{5}{12} + 4\frac{2}{3} = ?$ C. $18\frac{5}{9} + 14\frac{7}{12} = ?$

Test No. 9.

D. $42\frac{5}{8} - 12\frac{1}{8} = ?$ E. $161\frac{5}{6} - 4\frac{3}{8} = ?$ F. $18\frac{1}{4} - 3\frac{2}{3} = ?$

Practice adding: [With pencil.]

A.	1. $\frac{2}{9}$	2. $\frac{11}{12}$	3. $8\frac{2}{5}$	4. $14\frac{3}{4}$	5. $12\frac{5}{6}$	6. $21\frac{7}{8}$	7. $32\frac{11}{16}$
	$\frac{1}{9}$	$\frac{5}{12}$	$4\frac{1}{5}$	$5\frac{1}{4}$	$14\frac{5}{6}$	$16\frac{7}{8}$	$24\frac{15}{16}$
B.	1. $\frac{3}{8}$	2. $\frac{5}{12}$	3. $7\frac{1}{16}$	4. $10\frac{1}{12}$	5. $12\frac{3}{4}$	6. $18\frac{11}{15}$	7. $35\frac{9}{14}$
	$\frac{1}{4}$	$\frac{5}{6}$	$3\frac{1}{2}$	$11\frac{3}{4}$	$14\frac{11}{16}$	$4\frac{2}{3}$	$17\frac{6}{7}$
C.	1. $\frac{1}{4}$	2. $\frac{5}{6}$	3. $9\frac{1}{6}$	4. $15\frac{3}{4}$	5. $27\frac{1}{4}$	6. $28\frac{1}{6}$	7. $54\frac{5}{6}$
	$\frac{1}{3}$	$\frac{1}{10}$	$8\frac{1}{8}$	$18\frac{4}{5}$	$14\frac{5}{6}$	$14\frac{8}{9}$	$39\frac{4}{15}$

Practice subtracting:

D.	1. $\frac{5}{7}$	2. $\frac{15}{16}$	3. $9\frac{4}{9}$	4. $18\frac{7}{8}$	5. $16\frac{7}{12}$	6. $36\frac{5}{6}$	7. $29\frac{11}{16}$
	$\frac{1}{7}$	$\frac{8}{16}$	$5\frac{2}{9}$	$2\frac{1}{8}$	$7\frac{1}{12}$	$19\frac{1}{6}$	$14\frac{5}{16}$
E.	1. $\frac{15}{16}$	2. $\frac{7}{8}$	3. $7\frac{5}{12}$	4. $16\frac{2}{3}$	5. $24\frac{3}{4}$	6. $37\frac{11}{15}$	7. $42\frac{5}{6}$
	$\frac{3}{4}$	$\frac{5}{6}$	$2\frac{1}{3}$	$4\frac{1}{8}$	$19\frac{7}{12}$	$24\frac{2}{5}$	$19\frac{11}{15}$
F.	1. $8\frac{1}{2}$	2. $22\frac{2}{3}$	3. 12	4. 15	5. 20	6. 36	7. $8\frac{1}{4}$
	4	7	$4\frac{1}{3}$	$4\frac{1}{4}$	$6\frac{2}{3}$	$14\frac{3}{4}$	$2\frac{3}{4}$
	8. $16\frac{1}{3}$	9. $25\frac{1}{3}$	10. $14\frac{1}{3}$	11. $24\frac{2}{5}$	12. $16\frac{2}{3}$	13. $24\frac{3}{8}$	14. $19\frac{3}{4}$
	$8\frac{2}{3}$	$12\frac{1}{2}$	$7\frac{3}{4}$	$8\frac{2}{3}$	$7\frac{3}{4}$	$18\frac{5}{6}$	$7\frac{11}{12}$

III

[Use pencil only when needed.]

1. Multiply: 120 by $2\frac{2}{3}$; $40\frac{1}{4}$ by 8; $2\frac{1}{2}$ by $\frac{2}{5}$; $2\frac{1}{4}$ by $1\frac{1}{3}$.

2. In finding the products above, which multiplications were most conveniently performed without a reduction of the mixed number to an improper fraction? Which with a reduction?

3. Find the cost of $6\frac{3}{4}$ yd. of goods at 8¢ a yard? At $12\frac{1}{2}$¢?

4. Multiply: $12\frac{1}{3}$ by 6; 84 by $2\frac{3}{4}$; $6\frac{1}{4}$ by $\frac{1}{2}$; $8\frac{1}{3}$ by $\frac{2}{5}$; $\frac{5}{6}$ by $7\frac{1}{2}$; $33\frac{1}{3}$ by $1\frac{1}{2}$.

What is the product of 472 and $19\frac{3}{5}$?

$$\begin{array}{r} 472 \\ 19\frac{3}{5} \\ \hline 5\,|\underline{1416} \\ 283\frac{1}{5} \\ 4248 \\ 472 \\ \hline 9251\frac{1}{5} \end{array}$$

In multiplying 472 by the fraction $\frac{3}{5}$, since the work cannot be carried easily in the mind, the 472 is first multiplied by the numerator 3, and the product divided by the denominator 5. This answer ($283\frac{1}{5}$) added to the partial products found by multiplying 472 by 19 gives the final answer, $9251\frac{1}{5}$.

[With pencil.]

5. Find the product of 360 and $24\frac{3}{8}$. Of 775 and $14\frac{3}{4}$. Of $416\frac{2}{3}$ and 75. Of $458\frac{2}{5}$ and 164.

6. How many lengths $\frac{3}{4}$ of a yard long can be cut from 15 yards of goods? How many lengths $1\frac{1}{4}$ yards long can be cut from $4\frac{3}{8}$ yards?

7. In the division of fractions, which fraction is inverted?

8. What change is made in a mixed number used in division?

9. Divide: 12 by $\frac{2}{3}$; 15 by $\frac{7}{8}$; $4\frac{1}{5}$ by $\frac{8}{7}$; 18 by $1\frac{1}{2}$; $11\frac{2}{3}$ by $2\frac{1}{3}$.

IV

If, in these tests, you fail to get the correct answer to any problem, practice solving the problems in the set having the same letter, then try the problem again.[1]

Test No. 10. A. $34\frac{2}{3} \times 18 = ?$ B. $360 \times 12\frac{3}{8} = ?$ C. $19\frac{1}{5} \times 6\frac{1}{4} = ?$

Test No. 11. D. $\frac{5}{12} \div \frac{3}{8} = ?$ E. $6\frac{1}{4} \div 1\frac{2}{3} = ?$ F. $47\frac{3}{5} \div 14 = ?$

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[1] See fraction exercises on pages 306-315 also.

[Use pencil only when needed.]

Find products and quotients:

A.

1. $\frac{2}{3} \times 360$.
2. $\frac{3}{4} \times 18$.
3. $22\frac{1}{2} \times 4$.
4. $31\frac{2}{3} \times 6$.
5. $42\frac{3}{4} \times 7$.
6. $34\frac{1}{3} \times 24$.
7. $21\frac{3}{8} \times 27$.

B.

1. $28 \times \frac{6}{7}$.
2. $21 \times \frac{3}{4}$.
3. $42 \times 1\frac{1}{2}$.
4. $14 \times 2\frac{2}{5}$.
5. $240 \times 21\frac{2}{3}$.
6. $35 \times 14\frac{3}{4}$.

C.

1. $\frac{2}{3} \times \frac{4}{5}$.
2. $\frac{3}{4} \times \frac{4}{9}$.
3. $1\frac{4}{5} \times \frac{5}{16}$.
4. $\frac{5}{12} \times 1\frac{2}{5}$.
5. $2\frac{1}{4} \times 5\frac{1}{3}$.
6. $12\frac{1}{2} \times 3\frac{1}{5}$.
7. $2\frac{1}{3} \times 9\frac{1}{2}$.

D.

1. $6 \div \frac{3}{4}$.
2. $7 \div \frac{2}{3}$.
3. $\frac{5}{8} \div \frac{2}{3}$.
4. $\frac{5}{16} \div \frac{5}{8}$.
5. $\frac{3}{4} \div \frac{3}{5}$.
6. $\frac{4}{5} \div \frac{3}{8}$.

E.

1. $21 \div 3\frac{1}{2}$.
2. $\frac{5}{8} \div 1\frac{1}{4}$.
3. $\frac{3}{4} \div 3\frac{1}{2}$.
4. $3\frac{3}{5} \div 3\frac{1}{5}$.

F.

1. $\frac{3}{4} \div 4$.
2. $\frac{4}{5} \div 8$.
3. $37\frac{1}{2} \div 6$.
4. $14\frac{2}{5} \div 12$.

7. Review of Division as Comparison or Ratio

[Without pencil.]

1. At 35¢ a dozen how much must be paid for 8 pears? For 18?

2. In solving the problems above, what comparisons is it convenient to make?

3. Compare: 25¢ with 75¢. 9 in. with 1 yd. 120 lb. with 30 lb.

4. What is the comparison, or ratio, of 20¢ to 30¢? Of 30¢ to 20¢?

The comparison, or ratio, of two numbers is found by expressing the division of one by the other.

The ratio of 20¢ to 30¢ = 20 ÷ 30, or $\frac{20}{30}$. $\frac{20}{30}$ = —.
The ratio of 30¢ to 20¢ = 30 ÷ 20, or $\frac{30}{20}$. $\frac{30}{20} = \frac{3}{2}$, or —.

Find the ratio of:

5. 20 to 10. To 40; 60; 50.
6. 18 to 6. To 12; 24; 54.
7. 14 to 28. To 42; 70; 77.
8. 24 to 8. To 72; 48; 80.
9. 25 to 15. To 35; 45; 60.
10. 36 to 9. To 27; 18; 108

11. What is the ratio of 3 eighths to 7 eighths? Of $\frac{7}{12}$ to $\frac{11}{12}$?

12. What is the ratio of $\frac{5}{16}$ of a yard to $\frac{7}{8}$ of a yard?

The ratio of two unlike fractions may be found by reducing the fractions to a common denominator and comparing their numerators, or it may be found by performing the division by inverting the terms of the divisor.

13. Find the ratio of: $\frac{3}{4}$ to $\frac{3}{8}$; $\frac{7}{8}$ to $\frac{1}{2}$; $\frac{5}{12}$ to $\frac{1}{6}$; $\frac{1}{2}$ to $\frac{1}{3}$; $\frac{3}{4}$ to $\frac{1}{3}$; $\frac{2}{5}$ to $\frac{1}{2}$; $\frac{7}{8}$ to $\frac{1}{3}$; $\frac{1}{4}$ to $\frac{5}{6}$; $\frac{1}{5}$ to $\frac{3}{4}$.

14. Make a drawing showing the relation of 1 yard to $\frac{3}{4}$ of a yard. To $\frac{2}{3}$ of a yard. To $\frac{7}{8}$ of a yard.

15. What ratio does a unit or whole bear to $\frac{3}{4}$ of itself? To $\frac{2}{3}$ of itself? To $\frac{7}{8}$ of itself?

16. What is the ratio of 1 to $\frac{5}{8}$? To $\frac{3}{16}$? To $\frac{1}{12}$? To $\frac{4}{9}$?

17. Paper napkins are selling at the rate of $1.00 for 1000. At this rate, how much must be paid for 500? For 800?

18. How much must be paid for 18 spools of thread selling at 50¢ a dozen? For $\frac{1}{2}$ doz. dust cloths selling at 3 for 25¢? For 1 doz. papers of pins selling at 2 papers for 15¢?

19. When soap sells at the rate of 4 bars for 25¢, how many bars can be bought for 75¢? For $1.50?

20. Packages of tea containing $\frac{3}{4}$ of a pound are selling for 45¢. At this rate, how much should be paid for a half-pound package? For a package weighing $1\frac{1}{2}$ lb.?

21. Two thirds of a yard of goods is bought for 40¢. At this rate how much should be paid for a yard?

[With pencil.]

22. A man spends for rent $360 out of an income of $1500. What part of his income is spent in this way?

$\$360 = \frac{360}{1500}$ of $\$1500$. $\frac{360}{1500}$ reduced to lowest terms = —.

23. A young man purchased a country newspaper for $3500. Of this expense, $1750 was for the plant, consisting of type and material with which to set up an eight-page paper. The cost of the plant was what part of the total cost?

24. It cost the young man $170 a week to run his newspaper. The expense of printing the paper came to $75 a week; the expense for articles and news, including the editor's salary, came to $35 a week; and the business and other running expenses, to $60 a week. Each item was what part of the total weekly expense?

25. The total income per week was $212. Of this amount, $82 came from the sale of papers, and $130 from advertisements. What part of the total income was derived from each? (Give both approximate and exact answers.)

*26. The young man's profit was approximately what part of the cost of running his business? What part of the income?

Find the ratio of:

27. 4800 to 6000.
28. 540 to 3600.
29. 375 to 6250.
30. 216 to 144.
31. 1080 to 810.
32. $\frac{5}{8}$ to $\frac{2}{3}$.
33. $\frac{4}{5}$ to $\frac{3}{4}$.
34. $2\frac{1}{3}$ to $\frac{2}{3}$.
35. $4\frac{1}{2}$ to $\frac{3}{4}$.
36. $1\frac{3}{8}$ to $\frac{1}{4}$.
37. $7\frac{1}{2}$ to $2\frac{1}{2}$.
38. $6\frac{1}{4}$ to 25.
39. $8\frac{1}{3}$ to $33\frac{1}{3}$.
40. $16\frac{2}{3}$ to $83\frac{1}{3}$.
41. $137\frac{1}{2}$ to $87\frac{1}{2}$.

*42. Find the number that is $\frac{2}{3}$ of 9600 when the number is increased $\frac{1}{7}$.

*43. Find the number that is $1\frac{1}{4}$ times 3200 when the number is diminished $\frac{3}{5}$.

8. Indicating the Solution of a Problem

I

(1) $10 \times (12 - 7) = ?$

The parentheses enclosing the expression 12 − 7 indicate that 7 is to be subtracted from 12 before the multiplication is performed. Since $12 - 7 = 5$ and $10 \times 5 = 50$, then $10 \times (12 - 7) = 50$.

(2) $\dfrac{200 - (35 + 50 + 40)}{15} = ?$

In solving this problem, the value of the numbers above the line is first found, and this result divided by the number below the line.

$200 - (35 + 50 + 40)$ is equivalent to $200 - 125$, or 75.

$75 \div 15 = 5$. Therefore, $\frac{200 - (35 + 50 + 40)}{15} = 5$.

[Use pencil only when needed.]

Solve:

1. $40 - (10 + 5) = ?$
2. $10 \times (75 - 25) = ?$
3. $(48 - 12) \div 3 = ?$
4. $160 \div (25 - 9) = ?$
5. $20 \times (150 + 30) = ?$
6. $(500 + 250) \div 25 = ?$
7. $\frac{240 - (100 + 20)}{2} = ?$
8. $48 - (16\frac{2}{3} + 24\frac{1}{2}) = ?$
9. $(640 \times 1\frac{1}{2}) - (24 \times 33\frac{1}{3}) = ?$
10. $250 \div (18\frac{3}{4} - 6\frac{1}{4}) = ?$
11. $(24\frac{1}{2} + 18\frac{1}{8}) \times 120 = ?$
12. $(375 + 450) \div 37\frac{1}{2} = ?$
13. $\frac{320 - (4 \times 35)}{24} = ?$
14. $\frac{(120 \times 1\frac{2}{3}) - (75 + 25)}{12\frac{1}{2}} = ?$
15. $(8 \times 37\frac{1}{2}) - (9 \times 16\frac{2}{3}) = ?$

II

[With pencil.]

1. Corn raised at a cost of \$.48 a bushel is sold for \$1.05 a bushel. What is the profit on 500 bu.? What is $\frac{1}{2}$ the profit on 300 bu.?

The profit on 500 bu. = 500 × (\$1.05 − \$.48), or —.

The profit on $\frac{1}{2}$ of 300 bu. = $\frac{300 \times (\$1.05 - \$.48)}{2}$, or —.

Indicate solution of problem, then solve:

2. Two boys run a newspaper route, dividing the profit between them equally. In one week the expenses come to \$7.20; the receipts, to \$12.40. Find each boy's share of the profit.

3. A man earning 75¢ an hour on an 8-hour day schedule receives how much more per day than a man earning 50¢ an hour on a 9-hour day schedule?

4. With double pay for overtime, how much should a man receive for a week's work, if he works 44 hours at 80¢ an hour and $4\frac{1}{2}$ hours overtime?

5. A man receives 90¢ an hour for 48 hours of work in one week, and, in addition, double pay for 5 hours overtime. Out of his week's earnings he wishes to deposit $\frac{1}{5}$ in a savings bank. How much should he deposit?

6. How much is left from a month's earnings after paying for 4 weeks' board at $7.50 a week, when wages are $4.50 a day and the number of working days in the month, 26?

7. A lawyer receives, besides a yearly salary of $2200, fees that average $25 a week. Find his daily income.

*8. The weight of a wagon when loaded with hay is 3420 lb.; when unloaded, 1210 lb. At $30.50 a ton, what is the value of the load of hay?

*9. Make and solve a problem similar to problem 1. Make and solve one similar to problem 2; also, one similar to problem 6.

9. Short Methods and Review

I

What is the product when 64 is multiplied by 5? By 50? By 25?

$64 \times 5 = ?$	$64 \times 50 = ?$	$64 \times 25 = ?$
64	64	64
10	100	100
$2\,\underline{\big\lvert 640}$	$2\,\underline{\big\lvert 6400}$	$4\,\underline{\big\lvert 6400}$
320	3200	1600

[Use pencil only when needed.]

1. Judging from the problems above, what is a short method of multiplying a number by 5? By 50? By 25?[1]

2. Find a short method of multiplying by $33\frac{1}{3}$; by $12\frac{1}{2}$; by $16\frac{2}{3}$.

---

[1] To understand these short cuts, it is helpful to reason in this way: Since 25 is $\frac{1}{4}$ of 100, to multiply by 25 is the same as to multiply by 100 and then divide by 4.

Find the products, using a short method:

3. $42 \times 5 = ?$
4. $62 \times 5 = ?$
5. $248 \times 5 = ?$
6. $764 \times 5 = ?$
7. $765 \times 5 = ?$
8. $84 \times 50 = ?$
9. $48 \times 50 = ?$
10. $36 \times 50 = ?$
11. $784 \times 50 = ?$
12. $549 \times 50 = ?$
13. $48 \times 25 = ?$
14. $88 \times 25 = ?$
15. $36 \times 25 = ?$
16. $964 \times 25 = ?$
17. $785 \times 25 = ?$
18. $12 \times 33\frac{1}{3} = ?$
19. $96 \times 33\frac{1}{3} = ?$
20. $693 \times 33\frac{1}{3} = ?$
21. $924 \times 33\frac{1}{3} = ?$
22. $700 \times 33\frac{1}{3} = ?$
23. $80 \times 12\frac{1}{2} = ?$
24. $168 \times 12\frac{1}{2} = ?$
25. $656 \times 12\frac{1}{2} = ?$
26. $744 \times 16\frac{2}{3} = ?$

II

Find answers: [With pencil.]

1. $\frac{5}{12} + \frac{4}{16} + \frac{7}{8} = ?$
2. $3\frac{1}{8} + 6\frac{5}{12} + 4\frac{2}{3} = ?$
3. $18\frac{2}{3} - 9\frac{5}{12} = ?$
4. $27\frac{2}{5} - 18\frac{3}{4} = ?$
5. $16\frac{2}{3} \times 24 = ?$
6. $72 \times 14\frac{3}{4} = ?$
7. $17\frac{1}{2} \times \frac{2}{5} = ?$
8. $24 \div \frac{5}{16} = ?$
9. $8\frac{1}{3} \times (6\frac{1}{2} - 2\frac{7}{8}) = ?$
10. $(125 - 37\frac{1}{2}) \div 6\frac{1}{4} = ?$
11. $\dfrac{16\frac{5}{8} + 14\frac{1}{5}}{4} = ?$
12. $\dfrac{\frac{5}{16} \times 120}{33\frac{1}{3}} = ?$
13. Express the ratio of 450 to 750. Of $\frac{3}{4}$ to $\frac{7}{8}$. Of $6\frac{1}{4}$ to $37\frac{1}{2}$.

10. Thrift Problems — How to Save

Money spent for health and education is wisely spent. Every one needs wholesome food, warm clothing, a well-kept home, and a good education. Money should be spent, too, for the relief of suffering and to help good causes.

Name some of the wasteful ways of spending money. Why should every one in our country, as a patriotic duty, learn how to save?

Successful business men, farmers, and housekeepers often make plans for spending money called budgets. These show what money they expect to receive and how they intend to use it. It will help you to spend your money wisely, and to save more, if you, too, form the habit of planning ahead. In making a budget of your own, the form given here may be used.

BUDGET FOR THE WEEK BEGINNING OCTOBER 2

Income			Use		
On hand		40	Thrift Stamp		25
Allowance		10	Pencil		05
Earnings		25	Hair cut		35
			On hand		10
Total		75	Total		75

[Use pencil only when needed.]

Find how much each of these children would save in a week if each followed his budget:

1. Henry J. earns 5¢ a day (6 days a week) helping his mother, and receives from his father 25¢ a week for spending money. He plans to spend during the week 15¢ for school, and 20¢ in other ways.

2. Frank M. earns $2.40 a week from a newspaper route and plans to spend $1.30.

3. Margaret F. has earned $1.20, which she has on hand. Her father has promised to give her during the week a dollar for a birthday present. Margaret expects to spend 50¢ for a new book and to buy 3 handkerchiefs at 25¢ apiece.

4. John L. has 75¢ on hand. He has an allowance from his father of $2.00 a week for carfare and other expenses. He expects to earn 35¢. His carfare comes to 60¢, his lunches to $1.00. He pays 25¢ a week to his church.

5. Raymond S. has $2.48. He earns 50¢ each Saturday working for a grocer and 35¢ a week helping his father. He plans to buy a baseball for $1.25 and to get a hair cut costing 35¢.

6. Make and solve three problems like those above basing them on your own probable receipts and expenses.

In making a budget for a family of five with an income of from $20 to $30 a week, the amounts spent out of each dollar might be as follows: For food, 5 dimes; for rent (or other house expense), 2 dimes; for housekeeping (heat, light and supplies), 1 dime; for clothing, 1 dime; for personal expenses (carfare, etc.) $\frac{1}{2}$ dime; for savings, $\frac{1}{2}$ dime.[1]

[With pencil.]

7. Out of a family income of $20 a week, how much should be spent for each item named above? Make a list in column form beginning with: Food — $10.

8. Write in column form the amount that should be spent for each item out of an income of $22.50 a week. Out of an income of $25 a week. Of $27.50 a week.

*9. A family were desirous of saving money to pay for the education of the children. By taking a smaller house than the one they had been occupying, they reduced the monthly rent of $32.50 to $25.00, and the cost of fuel from $80.00 a year to $48.00. By careful management, they reduced $\frac{1}{5}$ the former expense of $24.90 for lighting, and saved $42.40 on incidentals. Find how much was saved during the one year.

11. Thrift Problems: Buying Food Economically

Some of the rules to follow in buying food are: Buy food that is in season and is plentiful. Buy from the market that offers the lowest price for good quality. Buy inexpensive foods that are nutritious in place of expensive ones.

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[1] The smaller the income and the more members to a family the larger must be the proportion spent for food. The food will tend to cost more than half the income if a family receives less than $20 a week, and less than half if they receive $30.

[Use pencil only when needed.]

Find the difference in the two prices given for the same article:

1. Oranges in season, 45¢ a dozen; out of season, 75¢ a dozen.

2. Celery in season, 20¢ a bunch; out of season, 35¢ a bunch.

3. Oysters in season, 60¢ a quart; out of season, 90¢ a quart.

4. Peaches, Saturday morning, 75¢ a basket; Saturday evening, 50¢ a basket.

5. Corn at high-priced store, 20¢ a can; the same brand at low-priced store, 2 cans for 35¢.

6. Sweet potatoes at high-priced store 4 lb. for 25¢; at low-priced store, 5 lb. for 25¢.

7. Rolled oats in bulk, 9¢ a pound; in packages, 15¢ a pound.

8. With the price of butter at 60¢ a pound and a good substitute for butter at 38¢ a pound, what is the difference in the cost of a week's supply of 4½ pounds?

9. Find the difference in the cost of a 5-pound roast of beef at 40¢ a pound and the same amount of a cut at 54¢ a pound.

10. Oranges come by the box and contain commonly, according to the size of the orange, 126, 150, 176, 200, or 216 oranges. How much is saved by buying a box containing 150 oranges for $6.25 instead of buying the oranges by the dozen at 60¢ a dozen?

*11. Find the amount saved or lost in buying a barrel of apples (2½ bu.) for $4.75 and allowing 2 pecks to spoil, instead of buying the apples by the peck at 50¢ a peck and avoiding waste.

12. Thrift Problems: Rent, Repairs, and Furnishings

[With pencil.]

1. An electric bell is to be put in a house, connecting the dining-room and the kitchen. The cost of the material is as follows: 75 ft. of insulated wire at 40¢ a pound (1 lb. = 150 ft.); 2 batteries at 25¢; 1 bell at 35¢; 1 pear punch-button at 25¢; 1 box of insulated staples at 15¢. The bell installed by the electric company costs $3.00 com-

plete. How much expense does a boy save his parents by putting in the bell, if they buy the materials?

2. Find the expense saved by making a swinging seat that costs $9.25 when bought ready made. The following materials are used: 30 ft. of lumber at 8¢ a foot; 4½ doz. screws at 10¢ a dozen; 12 yd. of chain at 2¢ a foot; 6 hammock hooks at the rate of 3 for 10¢; and 1 qt. of paint at 90¢.

3. A plumber sends in a bill for 12 ft. of galvanized pipe at 20¢, 6 galvanized elbows at 22¢, and 1 faucet at $1.75. He charges for 3½ hours' labor at $1.00 an hour. Find the amount due on the bill.

4. Find the change that should be received from a ten-dollar bill in paying a carpenter for 5½ hours' work at the rate of $7.20 for an 8-hour day.

5. Two houses are for rent, one at $18.00 a month, requiring for heating an average expense of $7.75 a month; the other at $27.50 a month, requiring for heating an average expense of $9.50 a month. Find the difference in the yearly expense for rent and heat.

6. How much more is paid a year by renting a room by the week at $2.50 than by the calendar month at $10.00?

*7. A family that had been renting a house at $45.00 a month bought the house for $4500. The average yearly expense for taxes was $58.25; for water, $10.00; for fire insurance, $11.25; for repairs, $78.50. The money invested in the house, if left in a bank, would have yielded an income of $15.00 a month. How much expense did the family save each month by owning the house?

CHAPTER II. THE FUNDAMENTAL PROCESSES
(continued)

13. The Use of Large Numbers

I

The grain crops in different states in the United States amount to millions of bushels each year; the exports and imports of the country, to billions of dollars. To interpret such facts and others of importance to us as a nation, it is necessary to know how to read and write numbers of twelve figures and more.

For convenience, large numbers are divided into periods of three orders each.

INTEGERS OF FIVE PERIODS

TRILLIONS				BILLIONS				MILLIONS				THOUSANDS				UNITS		
Hundred-trillions	Ten-trillions	Trillions		Hundred-billions	Ten-billions	Billions		Hundred-millions	Ten-millions	Millions		Hundred-thousands	Ten-thousands	Thousands		Hundreds	Tens	Units
3	2	1	,	4	1	0	,	7	2	5	,	9	3	4	,	6	3	5

The number 321,410,725,934,635 is read 321 trillion, 410 billion, 725 million, 934 thousand, 635.

Read the following numbers:

1. 3,000,000.
2. 3,000,000,000.
3. 3,500,000,000.
4. 5,575,000,000.

5. 5,075,000,000.
6. 8,032,000,000.
7. 75,045,040,000.
8. 104,007,008,000.
9. 500,008,000.
10. 200,050,000,900.
11. 40,006,080,000.
12. 2,500,500,000,000.

13. Read the facts in the following table:

THE COST OF THE GREAT WAR
TO THE ENTENTE POWERS AND ALLIES

Great Britain	$33,420,000,000	France	$31,324,000,000
Canada	1,545,000,000	Russia	26,522,000,000
Australia	1,461,000,000	United States	23,159,000,000
India	584,000,000	Italy	15,636,000,000
New Zealand	365,000,000	Belgium	1,387,000,000
South Africa	243,000,000	Roumania	907,000,000
		Serbia	635,000,000

Total for the British Empire	$37,618,000,000
Total to the Entente Powers	$137,188,000,000

TO THE CENTRAL POWERS

Germany	$46,355,000,000	Turkey	$1,802,000,000
Austria-Hungary	24,858,000,000	Bulgaria	732,000,000

Total to the Central Powers	$73,747,000,000
Total War Expenditures	$210,935,000,000

In expressing large numbers, it is often convenient to use round numbers. For example, to give an idea of the number of miles from the earth to the sun, the round number 93,000,000 is used in place of the more exact number, 92,894,800.

In expressing 92,894,800 as 93,000,000, the number is correct to the nearest million. The numbers in the table above are, also, correct to the nearest million.

In using round numbers, a number with the value of 5 or more may be counted as 1 of the next higher order; a number of less than 5 may be disregarded. 27,515,000 may be called 28,000,000 27,415,000 may be called 27,000,000.

14. Write in round numbers making each correct to the nearest million: 24,792,321; 102,211,412; 415,806,792; 1,273,032,472; 9,876,796,243; 8,072,096,789.

II. Facts about Railways

[With pencil.]

First explain how to solve each of the following problems, and then find the answers:

1. The United States has more miles of railway than any other country in the world. According to the last census, this mileage had increased in thirty years from 93,296 miles to 240,830 miles. What was the average number of miles built per year?

Method of Solution: $\frac{240{,}830 - 93{,}296}{30}$ = average number of miles built per year.

2. During the same number of years, the number of miles of railway in Canada increased from 7194 miles to 24,731 miles. The average number of miles built per year in the United States during the period was how much greater than the average number built in Canada?

3. The money invested in the 240,830 miles of railway in the United States was $14,338,575,940. This was how much per mile?

4. The cost of a railway locomotive averages about 23¢ a pound. At this rate, what is the cost of an engine having a weight of 101,420 lb. on the driving wheels; 40,920 lb. on the front truck, and 45,420 lb. on the trailing wheels?

5. In one year, a railway company bought 5 freight engines costing $50,000 apiece, and 2 costing $65,000. What was the total expense?

6. A through passenger train was equipped with a locomotive purchased at $45,000; 2 baggage cars, at $25,000; 1 mail car, at $25,000; 3 day coaches, at $32,000; 1 diner, at $38,000; and 5 steel sleeping cars, at $40,000. Find the total cost.

7. A mile of railway track is laid of rails weighing 90 lb. a yard. At $48 a ton, what is the cost of the rails? (Since 2 rails are required for a track, allow 180 lb. for each yard of track.)

8. The other expenses for building each mile of railway are: for grading, $10,000; for ties, 3000 at $.78; for labor in laying track and ballasting with gravel, $8000; for spikes, plates, and other material, $150. How much does the mile of railway cost?

9. At the rate given above, approximately how many miles of railway can be built for $1,250,000?

*10. In a recent year, the value of the equipment of the railways in the United States was estimated as follows: 60,890 locomotives at $22,000; 50,000 passenger cars at $10,000; 2,193,000 freight cars at $1000; 113,400 company's cars at $1000. What was the total estimate of the equipment?

*11. The number of miles of railway built in the United States between 1860 and 1870 was 22,000; between 1870 and 1880, 40,000; between 1880 and 1890, 66,000; between 1890 and 1900, 35,000; between 1900 and 1910, 46,000. Using squared paper, make a graph of this record.

14. Roman Numerals

The figures ordinarily used in statistics and in computing are **Arabic numerals**; those used for numbering the chapters of a book, and occasionally for writing dates, are **Roman numerals.**[1]

The Arabic numerals are: 1, 2, 3, 4, 5, 6, 7, 8, 9.

The Roman numerals are: I (one); V (five); X (ten); L (fifty); C (one hundred); D (five hundred); and M (one thousand).

1. To represent, in the Roman notation, the date of the printing of the first book in English, the letters used are MCDLXXIV. In this number, the M stands for one thousand, the CD for four hundred, the LXX for seventy, and the IV for four. The date was —.

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[1] For the history of both the Arabic and the Roman notation, see an encyclopedia.

2. Why is the Roman notation called an additive system?

3. In the numbers CD (400) and IV (4), letters standing for a smaller quantity are placed at the left of letters of larger quantity. How is the value of such numbers found?

Read:

4. V, VI, VIII, IV.
5. X, XI, IX, XIX.
6. L, LXX, XL, XLIX.
7. C, XC, CXL.
8. D, DC, CD, CDXL.
9. M, MDCC, MDCXLIX.

Read these statements:

10. The first folio of Shakespeare was published in MDCXXIII.

11. "Pilgrim's Progress" was printed in MDCLXXVIII.

12. "Ivanhoe" was published in MDCCCXIX.

13. "Treasure Island" was published in MDCCCLXXXII.

14. Write in Roman notation the numbers of the chapters of a book from one to fifty.

***15.** Write in Roman notation the year of: the discovery of America by Columbus; the first circumnavigation of the globe (1519); the landing of the Pilgrim Fathers; the invention of the steamboat (1807); the first flight of an airship (1903); the first sending of a wireless message (1907).

15. Reading and Writing Decimals

1. $\frac{1}{10}$ of 1000 is written 100; $\frac{1}{10}$ of 100 is written 10; $\frac{1}{10}$ of 10 is written 1. How is $\frac{1}{10}$ of 1 written? $\frac{1}{10}$ of $\frac{1}{10}$? $\frac{1}{10}$ of $\frac{1}{100}$?

2. Read: 1000, 100, 10, 1, .1, .01, .001.

3. What is the ratio of each number above to the one at its left? (See problem **2.**) To the one at its right?

4. Which of the numbers are integers? Which decimals?

5. What is meant by a decimal system of numbers? By a decimal fraction, or decimal? [1]

Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
.2	1	3	5	4	6

6. The names of the decimal orders are formed from the names used for integers. Name the first six orders at the right of the decimal point.

7. What are the first three orders written to the right of millionths? Why are these so seldom used?

8. What denominator is given to a decimal of one figure? Of two figures? Of three figures? Of six figures?

In reading a decimal containing a fraction, the fraction is given the denomination of the decimal order at its left. For example, .016$\frac{2}{3}$ is read sixteen and two thirds thousandths.

9. Give the denomination, then read: .7; .7$\frac{1}{3}$; .02; .02$\frac{1}{4}$.

Read:

10. .5
11. .05
12. .005
13. .0005
14. .22
15. .022$\frac{1}{6}$
16. .4022
17. .3004
18. 4.08
19. 4.008
20. 24.03$\frac{1}{3}$
21. 75.006$\frac{1}{4}$
22. 42.0375
23. 84.2004
24. 124.33$\frac{1}{3}$
25. 87.088$\frac{1}{6}$
26. .00025
27. .01025
28. .000875
29. 485.0625
30. 1756.003$\frac{1}{3}$
31. 85,469.07$\frac{1}{6}$.
32. 24.01075
33. 92.807095

---

[1] Decimal fractions were first written with their denominators expressed; later, with a line under the numerator; and finally, as now, with a decimal point. For example, 25 thousandths was first written $\frac{25}{1000}$; later, $\underline{025}$; and finally, .025.

Write as decimals:

34. 75 thousandths.

35. $75\frac{1}{3}$ ten-thousandths.

36. 125 ten-thousandths.

37. 1055 millionths.

38. 1055 hundred-thousandths.

39. 125 hundred-thousandths.

40. 14 and $625\frac{1}{4}$ ten-thousandths.

41. 129 and 75 hundred-thousandths.

42. One thousand nine hundred forty-five hundred-thousandths.

43. One thousand forty-five hundred-thousandths.

44. Four and one thousand twenty-two hundred-thousandths.

45. Two hundred four and four thousand seventy-two millionths.

46. One thousand twenty and one hundred twelve ten-thousandths.

47. Five thousand nine and two thousand eight hundred twelve millionths.

16. Acquiring Skill in the Use of Decimals

I. Addition and Subtraction

[With pencil.]

1. From the sum of 2.175 and 3.25, subtract 4.8. What is the difference?

2. In the addition and subtraction of decimals, why is it necessary to write the numbers so that the decimal points fall under each other? Upon what principle is this based?

3. What is the distance covered by an airship in three hours, if the first hour it makes 66.25 miles; the second hour, 63.5 miles; and the third hour, 71.375 miles?

4. Find the sum of: 14.5 ft., 140.25 ft., 375.875 ft., and 8.8 ft. Also, of: 24.125 yd., 16.8 yd., 40.75 yd., and 72.5 yd.

5. Subtract $2.25 from $10. 1.75 miles from 10 miles. 112.24 acres from 200 acres.

6. Find the difference between 4.625 tons and 1.5 tons. Between 124.75 lb. and 75.98 lb. Between 84.5 rd. and 21.125 rd.

Find answers:

7. 4.125 + 12.75 + 8.6 = ?
8. 45 + 19.8 + .75 + 4.625 = ?
9. .875 + .625 + 14.8 + 94 = ?
10. .9 + .27 + .465 + 8 + 24 = ?
11. 20 + 45.75 + 119.9 + .375 = ?
12. 204.125 + 87.0495 = ?
13. 0.975 + 0.48 + 6.98 = ?
14. 175 + 0.78 + 0.14 + 48.9 = ?
15. 4.824 − 1.27 = ?
16. 14.7 − 3.24 = ?
17. 0.725 − 0.48 = ?
18. 42 − 9.128 = ?
19. 400 − 48.75 = ?
20. 8 − 0.125 = ?
21. 164.698 − 92.8 = ?
22. 7.46 − 6.982 = ?
23. 500 − 125.875 = ?
24. 1000 − 75.0625 = ?

II. Multiplication

[Use pencil only when needed.]

1. A fast train ran at the rate of .75 miles a minute. At this rate, how many miles did it travel in 2 minutes? In 2.5 minutes?

2. In the multiplication of decimals, how many places are pointed off in the product?

3. How many places should be pointed off in the product in multiplying .125 by .5? In multiplying 2.75 by .325? In multiplying .246 by 1.6$\frac{2}{3}$?

4. Making 21.25 miles per hour, how far can a steamboat go in 12.5 hours? In 24 hours?

5. Reduce: 2.125 tons to pounds; 14.5 rods to feet; 1.625 days to hours.

6. The distance covered by a ship in an hour is usually spoken of as so many knots or sea-miles. 1 knot = 1.1516 statute miles.

What is the rate of speed in statute miles of a steamer traveling at the rate of 18 knots? Of one traveling at 22.5 knots?

7. Paper is selling at $.015 a sheet. At this rate, how much must be paid for 10 sheets? For 100 sheets? For 1000 sheets?

8. What is a convenient way of multiplying a decimal by 10? By 100? By 1000?

9. Multiply by 10: .8; .16; .005; .003; 2.5; 1.375; 14.075.

10. Multiply each of the numbers in problem **9** above by 100. By 1000.

Multiply:

11. 1.125 by 8.
12. 2.625 by 12.
13. 0.075 by 24.
14. .00875 by 2.5.
15. 24.75 by .75.
16. 0.025 by .05.
17. 0.075 by $.02\frac{1}{3}$.
18. 9.612 by $.3\frac{2}{3}$.
19. 40.125 by $.12\frac{1}{6}$.

III. DIVISION

[Use pencil only when needed.]

1. How many rods are there in $\frac{1}{4}$ of 42.8 rods? In $\frac{1}{16}$ of 12.24 rods?

2. In dividing a decimal by an integer, how many places are pointed off in the quotient? Upon what principle is this based?

Divide:

3. 149.75 by 7.
4. 18.75 by 6.
5. 7.004 by 8.
6. 0.084 by 9.
7. 7.425 by 15.
8. 186.25 by 75.
9. 787.2 by 24.
10. 9.525 by 125.
11. .5332 by 124.

12. The distance between two places is 62.5 mi. What is $\frac{1}{10}$ of the distance? $\frac{1}{100}$ of it? $\frac{1}{1000}$ of it?

13. What is a convenient way of dividing a decimal by 10? By 100? By 1000?

14. Divide by 10: 87.5; .378; 2.4; .8; .05; 4.0075.

15. Divide by 100: 72.5; 36.42; 4.25; .75; 8.75; 9.054.

16. Divide by 1000: 365; 436.2; 24.5; 18.75; .28; .0125.

17. Divide 75,498 by 2000.

In dividing 75,498 by 2000, notice that the problem is equivalent to 75.498 ÷ 2$\cancel{0}\cancel{0}\cancel{0}$, or 75.498 ÷ 2. The number of decimal places pointed off in the dividend is the same as the number of zeros struck off from the divisor.

18. Divide: 54,965 by 5000; 174,975 by 300; 648,988 by 20,000; 2,495,784 by 400,000.

19. Divide: 78,775 by 2500; 71,488 by 32,000; 987,645 by 150,000; 22,266 by 1800; 913,275 by 1,250,000.

IV. Division (continued)

What is the rate of speed per hour if a train travels 121.25 miles in 2.5 hours? If it travels 1000 miles in 16.25 hours?

```
121.25 mi. ÷ 2.5 = ?

2.5|121.25

      4 8.5
2.5|121.2v5
    100
    ---
     212
     200
     ---
      125
      125
      ---

Rate = 48.5 mi.
```

```
1000 mi. ÷ 16.25 = ?

16.25|1000.

             61.538 +
16.25|1000.00v000
       9750
       ----
        2500
        1625
        ----
         8750
         8125
         ----
          6250
          4875
          -----
          13750
          13000
          -----

Rate = 61.538 + mi.
```

Notice that, in the solution of the problems above, by the use of a carat (v) a number of places equal to those in the divisor is marked off in each dividend, and the decimal point in the quotient is placed directly above it.[1]

To avoid error, place the decimal point in the quotient before performing the division.

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[1] For the reason underlying this method, see page 166, Part Four.

Notice the placing of the decimal point in each of these problems.

A. Excess Number of Decimal Places in the Dividend.	B. An Equal Number in Divisor and Dividend.	C. An Excess Number in the Divisor.
$\begin{array}{r}3\ 1.23\\ .3\overline{)9.3^{\vee}69}\end{array}$	$\begin{array}{r}2\ 1\\ .8\overline{)16.8^{\vee}}\end{array}$	$\begin{array}{r}18\ 0\\ .4\overline{)72.0^{\vee}}\end{array}$
$\begin{array}{r}12\ 08.\ 4\\ .06\overline{)72.50^{\vee}4}\end{array}$	$\begin{array}{r}4\\ .007\overline{).028^{\vee}}\end{array}$	$\begin{array}{r}230\ 400\\ .003\overline{)691.200^{\vee}}\end{array}$
$\begin{array}{r}.003\\ 3.25\overline{).00^{\vee}915}\end{array}$	$\begin{array}{r}3\\ 4.125\overline{)12.375^{\vee}}\end{array}$	$\begin{array}{r}8\\ 2.25\overline{)18.00}\end{array}$

Tell where the decimal point belongs in each quotient:

1. $\begin{array}{r}1\ 27\\ .7\overline{)8.89}\end{array}$
2. $\begin{array}{r}1529\\ .05\overline{).7645}\end{array}$
3. $\begin{array}{r}212\\ 3.2\overline{)6.784}\end{array}$
4. $\begin{array}{r}4\\ .2\overline{).008}\end{array}$
5. $\begin{array}{r}5\\ .3\overline{).015}\end{array}$
6. $\begin{array}{r}2\\ .24\overline{).00048}\end{array}$
7. $\begin{array}{r}3\ 982\\ .002\overline{)7.964}\end{array}$
8. $\begin{array}{r}124\ 2\\ 32.2\overline{)39992.4}\end{array}$
9. $\begin{array}{r}7\\ .005\overline{)35}\end{array}$
10. $\begin{array}{r}6\\ 1.25\overline{)75}\end{array}$
11. $\begin{array}{r}4\ 2\\ 3.16\overline{)1327.2}\end{array}$
12. $\begin{array}{r}36\\ 41.5\overline{)14940}\end{array}$

[With pencil.]

Practice solving the 12 problems above until you can get the decimal points in the correct places.

Find quotients, using care in placing the decimal points:

13. 68.112 ÷ .6.
14. 5.368 ÷ .04.
15. .13563 ÷ .003.
16. .7182 ÷ .21.
17. 10.3428 ÷ .442.
18. 4.864 ÷ 3.2.
19. .2976 ÷ 2.4.
20. .0854 ÷ 6.1.
21. .01284 ÷ 2.14.
22. 2.21875 ÷ 3.125.
23. 3718.4 ÷ 2.8.
24. 130.24 ÷ 3.52.
25. 415.296 ÷ .824.
26. 2.6775 ÷ .0063.
27. 68.4 ÷ .02.
28. 88.2 ÷ .21.
29. 4.8 ÷ .032.
30. 92.8 ÷ .0029.
31. 90 ÷ .125.
32. 240 ÷ 1.6.
33. 575.25 ÷ 25.
34. 675 ÷ 3000.
35. 11.571 ÷ 5.7.
36. 5.136 ÷ .214.
37. 126.36 ÷ .054.
38. 246.4 ÷ .154.
39. 794.5 ÷ .008.
40. 391 ÷ .46.
41. 41529 ÷ .082.
42. 14703 ÷ 348.

V. REDUCING A COMMON FRACTION TO A DECIMAL

What decimal is equivalent to $\frac{5}{16}$? To $3\frac{1}{300}$?

$\frac{5}{16} = 5 \div 16$, or .3125. $3\frac{1}{300} = 3 + (1 \div 300)$, or $3.003\frac{1}{3}$.

In reducing a common fraction to a decimal, it is usually unnecessary to carry the division more than three or four places.

$\frac{1}{300}$, for example, may be expressed decimally as $.003\frac{1}{3}$, or .0033+.

[With pencil.]

Express as decimals:

1. $\frac{3}{8}$, $\frac{1}{40}$, $\frac{3}{25}$.
2. $1\frac{7}{8}$, $2\frac{3}{5}$, $1\frac{5}{12}$.
3. $\frac{1}{6}$, $3\frac{1}{3}$, $4\frac{2}{3}$.
4. $\frac{3}{32}$, $\frac{1}{75}$, $\frac{3}{14}$.
5. $14\frac{5}{8}$, $1\frac{11}{12}$, $8\frac{5}{6}$
6. $\frac{1}{16}$, $14\frac{2}{7}$, $12\frac{5}{18}$.

Reduce each fraction to a decimal and find answers:

7. $14\frac{1}{4} + 15\frac{3}{5} = ?$
8. $42\frac{1}{8} - 12\frac{1}{2} = ?$
9. $24\frac{3}{10} \times 25 = ?$
10. $16\frac{3}{4} \times 5\frac{1}{2} = ?$
11. $4\frac{1}{8} \times 1000 = ?$
12. $12\frac{3}{8} \times 200 = ?$
13. $62\frac{1}{2} \div 6\frac{1}{4} = ?$
14. $300 \div 7\frac{1}{2} = ?$
15. $3000 \div 62\frac{1}{2} = ?$
16. $\dfrac{53 - (12\frac{3}{10} + 3\frac{1}{5})}{7\frac{1}{2}} = ?$
17. $\dfrac{142\frac{3}{8} - 27\frac{4}{5}}{3\frac{3}{4}} = ?$

17. Decimal Fractions in United States Money

I

The decimal parts of a dollar expressed by tenths and by hundredths are familiar through the use of silver dimes and copper cents. The decimal part, called a mill, which represents a thousandth of a dollar, is less familiar, owing to the fact that there is no coin to represent it. The mill is sometimes used, however, in making calculations; and it is necessary to know how to read and write it and its fractional parts.

\$.001 is read 1 mill.

\$.002$\frac{1}{4}$ is read $2\frac{1}{4}$ mills.

\$.0045 is read 4.5 mills.

\$.084 is read 8 cents 4 mills.

\$.0955 is read 9 cents 5.5 mills.

\$.2582 is read 25 cents 8.2 mills.

Read:

1. $.002
$.255
$.082
$1.055

2. $12.50
$1.25
$.125
$.0125

3. $\$.004\frac{1}{2}$
$\$.063\frac{3}{4}$
$\$.246\frac{2}{3}$
$.4375

4. $\$.223\frac{1}{3}$
$\$.006\frac{2}{3}$
$0.7533
$4.0052

Write as a decimal part of a dollar:

5. 3 mills.
6. $4\frac{1}{2}$ mills.
7. $2\frac{1}{4}$ mills.
8. $6\frac{1}{5}$ milis.
9. 2 cents 5 mills.
10. $3\frac{1}{2}$ cents.
11. 4 cents $3\frac{1}{2}$ mills.
12. 5 cents $5\frac{1}{5}$ mills.
13. $\frac{1}{2}$ of a mill.
14. $\frac{1}{8}$ of a cent.
15. $\frac{2}{5}$ of a cent.
16. $\frac{2}{5}$ of a mill.

[Use pencil only when needed.]

Write as decimal parts of a dollar and add:

17. $2\frac{1}{2}$¢, $3\frac{1}{4}$¢, $18\frac{1}{5}$¢, $12\frac{3}{4}$¢, $25\frac{1}{8}$¢, $\frac{3}{4}$¢.
18. 3 mills, $8\frac{1}{2}$ mills, $9\frac{1}{4}$ mills, $6\frac{1}{5}$ mills.
19. 2 cents, 2 mills, $4\frac{1}{2}$ cents, $8\frac{3}{4}$ mills, 6 cents, $3\frac{1}{2}$ mills.
20. $\$\frac{1}{2}$, $12\frac{1}{2}$¢, $2\frac{1}{2}$ mills, $\$\frac{3}{8}$, $\frac{1}{2}$¢, $\frac{1}{2}$ mill.
21. $2.50, 75¢, $2\frac{3}{4}$¢, $8\frac{1}{2}$ mills, 6¢, $\$\frac{1}{8}$.

22. Write in a decimal form and subtract: $13\frac{1}{2}$¢ from 75¢; $5\frac{3}{4}$¢ from 10¢; $4\frac{3}{4}$ mills from $1\frac{1}{2}$¢; 12 cents 8.5 mills from 25¢.

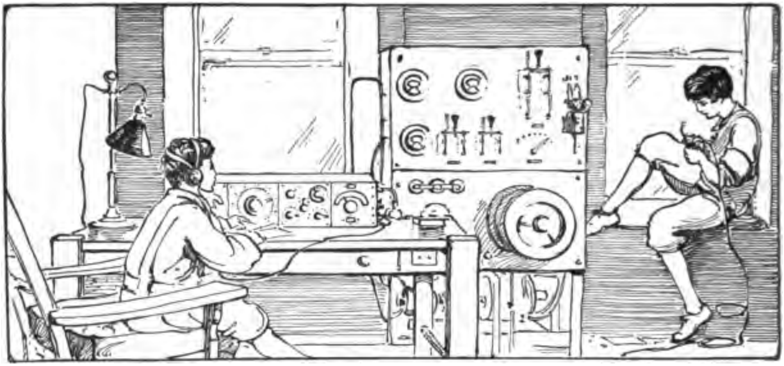
23. Multiply: $1.25 by 10; $.075 by 100; $.005 by 100; $.0025 by 1000.

24. Divide: $.25 by 10; $37.50 by 100; $.375 by 100; $625 by 1000.

Find answers, using a short cut wherever possible:

25. $\$.125 \times 50 = ?$
26. $\$.02\frac{1}{2} \times 400 = ?$
27. $\$.33\frac{1}{3} \times 900 = ?$
28. $\$.03\frac{1}{3} \times 30 = ?$
29. $\$.16\frac{2}{3} \times 36 = ?$
30. $\$.06\frac{1}{4} \times 2000 = ?$
31. $\$.005\frac{1}{2} \times 1000 = ?$
32. $\$.87\frac{1}{2} \times 640 = ?$
33. $\$.004\frac{3}{4} \times 500 = ?$

II. A Boy's Wireless



[Use pencil only when needed.]

A wireless outfit is made of three parts: (1) the aerial, (2) the sending apparatus, and (3) the receiver.

The following articles were bought for a boy's wireless. Find the cost of each:

1. 5 lb. of wire at 45¢ a pound.
2. 10 porcelain insulators at 3½¢ apiece.
3. 2 thirty-foot poles at $1.50 each.
4. 30 ft. of ground wire at 10¢ a foot.
5. 20 binding posts at 15¢ apiece.
6. 6 six-inch porcelain tubes at 5¢ apiece.
7. 20 pieces of glass at 5¢ apiece.
8. The items in problems, 1, 2, 3, and 4 with a lightning switch at $3.85 covered the cost of the aerial. How much was spent for this part of the wireless?
9. For the sending apparatus, besides the items in problems 5, 6, and 7, it was necessary to buy a battery at $1.80, a spark coil at $10.00, a key at $5.00, and miscellaneous articles at $2.75. How much did the sending apparatus cost?

10. The receiver consisted of a detector, a condenser, a tuner, and phones. The material for the detector came to 30¢; the material for the condenser to 25¢; and that for the tuner to $3.50. The phones cost $4.50. What was the cost of the receiver?

*11. Find the entire cost of the wireless outfit.

18. Review — Progress Score [1]

With the help of these tests measure your accuracy in computing. Try to make 100 points in each test, counting for each correct answer the score given in parenthesis near the letter of the problem. If you fail to get the correct answer to a problem, use for practice the exercise of the same kind and letter on pages 304–313.

I. ADDITION TEST

[Copy problems only when necessary.]

A. 8
(5) 7
6
8
7
4
9
8
6
7
7
5
4

B. 782
(6) 409
637
896
254
370
568
627
424

C. 5234
(7) 432
24315
3756
473
2413
32541
4238
5437

D. $8\frac{5}{8}$
(5) $7\frac{1}{8}$

E. $4\frac{11}{12}$
(6) $9\frac{5}{12}$

F. $24\frac{5}{16}$
(5) $17\frac{3}{8}$

G. $32\frac{9}{16}$
(7) $14\frac{1}{2}$

H. $48\frac{2}{3}$
(6) $24\frac{1}{5}$

I. $54\frac{5}{8}$
(8) $75\frac{5}{12}$

[Write answer without copying problem.]

J. $4.75 + $9.85 + $16.95 = ?
(6)

[Copy in column form and find answer.]

K. $144\frac{2}{3} + 125\frac{1}{2} + 327\frac{3}{4} = ?$
(8)

---

[1] To measure the progress of pupils, a record may be kept of these tests and after a stated time one of the four similar groups of tests be given (see pages 71, 123, 151, 252). Before giving the second group of tests, it will be found profitable to set aside, for those pupils who need the work, one or two five-minute periods a day for practice, using pages 304–313 according to the plan stated above, i.e. having each pupil practice on the types of problems on which he failed in the test.

Instead of taking the four tests in a group during successive periods the practice work connected with one test may be given before the next test is taken.

[Copy in column form and find answers.]

L. (6) \$214.75 + \$27.16 + \$7.24 + \$38 + \$14.72 + \$118.75 = ?

M. (8) \$1.75 + \$4.16 + $\$.09\frac{1}{2}$ + $7\frac{1}{2}$¢ + $4\frac{3}{4}$¢ + $9\frac{1}{2}$ mills = ?

N. (6) 42.324 + 8.42 + 24.54 = ? O. (11) $2.62 + 6.2\frac{3}{4} + 7\frac{3}{8} + 8\frac{4}{5} = ?$

Do work indicated: [Copy numbers only when necessary.]

II. Subtraction Test

A. (5) $\begin{array}{r}793545\\ \underline{47890}\end{array}$ B. (6) $\begin{array}{r}600300\\ \underline{124213}\end{array}$ C. (6) $\begin{array}{r}48\frac{7}{12}\\ \underline{23\frac{1}{12}}\end{array}$ D. (7) $\begin{array}{r}250\\ \underline{18\frac{7}{8}}\end{array}$ E. (8) $\begin{array}{r}33\frac{1}{4}\\ \underline{18\frac{3}{4}}\end{array}$

F. (6) $\begin{array}{r}14\frac{5}{12}\\ \underline{13\ \frac{1}{6}}\end{array}$ G. (9) $\begin{array}{r}48\frac{1}{6}\\ \underline{21\frac{1}{2}}\end{array}$ H. (7) $\begin{array}{r}18\frac{3}{4}\\ \underline{13\frac{1}{6}}\end{array}$ I. (9) $\begin{array}{r}427\frac{1}{2}\\ \underline{153\frac{4}{5}}\end{array}$ J. (5) $\begin{array}{r}\$20.00\\ \underline{3.18}\end{array}$

K. (8) \$31 − $17\frac{1}{2}$¢ = ? L. (6) 24.842 − 7.49 = ?

M. (7) 14.75 − 8.148 = ? N. (11) $12.31 - .4\frac{3}{4} = ?$

III. Multiplication Test

A. (5) $\begin{array}{r}9673\\ \underline{8}\end{array}$ B. (6) $\begin{array}{r}6172\\ \underline{39}\end{array}$ C. (6) $\begin{array}{r}5806\\ \underline{207}\end{array}$ D. (3) $48 \times \frac{3}{4} = ?$ E. (7) $\frac{2}{5} \times 72 = ?$

F. (9) $\begin{array}{r}27\frac{2}{3}\\ \underline{5}\end{array}$ G. (11) $\begin{array}{r}92\\ \underline{4\frac{3}{4}}\end{array}$ H. (12) $\begin{array}{r}125\\ \underline{21\frac{2}{5}}\end{array}$ I. (5) $\frac{2}{3} \times \frac{7}{8} = ?$ J. (8) $6\frac{1}{4} \times 2\frac{1}{5} = ?$

K. (8) $\begin{array}{r}17.25\\ \underline{13.6}\end{array}$ L. (8) $\begin{array}{r}.327\\ \underline{.013}\end{array}$ M. (12) $924.8 \times .04\frac{3}{5} = ?$

IV. Division Test

A. (4) $7\overline{)47631}$ B. (5) $81\overline{)40824}$ C. (6) $39\overline{)25428}$ D. (9) $156\overline{)916640}$

E. (5) $4 \div \frac{3}{8}$. F. (5) $\frac{2}{5} \div \frac{5}{6}$. G. (5) $\frac{3}{4} \div 4$. H. (6) $4\frac{2}{5} \div 3$ I. (7) $2\frac{3}{4} \div 1\frac{1}{2}$.

J. (8) $25\overline{)80.27}$ K. (7) $6.1\overline{).2623}$ L. (6) $.005\overline{)9.875}$ M. (8) $.24\overline{)360}$

N. (8) $5000\overline{)\$275}$ O. (11) $\dfrac{1164.75 - 18.12\frac{1}{4}}{1.25} = ?$

19. Cereal Crops in the United States

[Use pencil only when needed.]

The United States produces a large portion of the grains raised in the world; but, notwithstanding this fact, compared with that of other countries, the yield per acre is low. The following table gives, for a recent year, the average yield in bushels per acre in Great Britain and in the United States.

	WHEAT	BARLEY	OATS
Great Britain	35.0 bu.	38.9 bu.	45.9 bu.
United States	15.8 "	24.3 "	30.3 "

1. The average number of bushels of wheat raised per acre was how much greater in Great Britain than in the United States? This difference amounted to how much for each 100 acres?

2. Find the difference in the yield per acre for barley. For oats.

3. If an average yield of 15.8 bu. of wheat per acre in the United States were increased to the amount raised in Great Britain, as shown in the table, what would be the value of the increase per acre with wheat selling at $2.20 a bushel?

4. The leading wheat states are Minnesota, Kansas, and South Dakota. With a yearly allowance of 5.5 bu. per person, how many people can be supplied with wheat for bread from these three states alone, in a year when Minnesota raises 94,080,000 bu.; Kansas, 62,068,000 bu.; and South Dakota, 46,720,000 bu.?

5. A boy belonging to a corn club won a prize by raising on an acre of land 228.75 bu. of corn. This yield was how many times the average yield per acre for the United States of 25.9 bu.?

6. The leading corn states in the United States are Illinois, Iowa, and Nebraska. Find the number of freight cars with a capacity of 820 bu. that would be required to hold the crop for each state when the harvests were as follows: In Illinois, 298,620,000 bu.; in Iowa, 287,456,000 bu.; in Nebraska, 205,767,000 bu.

20. Our Dependence on Rainfall

1. The table below gives by seasons the average yearly rainfall for towns in five different regions in the United States. Which of the towns has the heaviest summer rainfall? Which the lightest?

AVERAGE YEARLY RAINFALL IN INCHES

	SPRING			SUMMER			FALL			WINTER		
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Desert Region, Nevada	.27	.07	.03	.0	.13	.32	.17	.23	.28	.49	.43	.42
Corn-belt, Illinois	3.09	3.63	4.71	4.35	3.10	2.46	3.22	2.71	3.01	2.6	2.45	3.14
Wheat Region, S. Da.	1.24	3.08	3.84	3.98	3.76	3.16	2.64	1.38	0.66	0.88	0.50	0.73
Fruit Region, Mich.	2.39	2.47	3.27	3.38	2.83	2.62	3.61	3.02	2.82	2.5	2.64	2.15
Pacific Forest Region	5.19	3.16	2.35	1.7	.58	.64	1.76	3.56	6.48	7.36	6.7	6.0

[With pencil.]

2. Using the table, find: (1) the total rainfall during the summer months for each place named; (2) the total yearly rainfall in each.

3. Compare by subtraction the total yearly rainfall of the town in the forest region with that of each of the other towns.

4. Make and solve three problems comparing the rainfall of the different towns by seasons.

*5. The average spring rainfall in a certain town in the cotton belt is 12 in.; the summer rainfall, 13 in.; the autumn rainfall, 9.5 in.; the winter rainfall, 14 in. Use squared paper and make a graph showing the rainfall by seasons.

*6. Make a graph showing approximately by seasons the rainfall for the forest region near the Pacific.

CHAPTER III. PERCENTAGE

21. The Use of Percentage in Reports

I

[Without pencil.]

1. Of the 200 days of school in a year, 14 were stormy. How many in each 100 did this make? What per cent?

2. Express as per cents: Number of pupils absent from school, $\frac{4}{100}$ of membership; number of pupils tardy, $\frac{2}{100}$ of membership; number of pupils neither absent nor tardy, $\frac{94}{100}$ of membership.

3. Express as a decimal fraction a record of: 1 per cent; 7 per cent; 9%; 12%; 75%.

4. The total number of books circulated from a library in a small city was 283,898 volumes for the year. The following table shows what part of the total circulation was from each department. Read the report, giving the decimal equivalent for each per cent:

	VOLUMES CIRCULATED	PER CENT OF TOTAL VOLUMES CIRCULATED
Fiction	181,696	64
Essays, poetry, and drama	22,712	8
Periodicals	21,292	7½
Geography and travel	14,195	5
History and biography	19,873	7
Science, philosophy, and religion	24,131	8½

5. In the report above, which per cent expresses the largest proportion of the circulation? Which the smallest?

6. Can you find the reason why reports, such as the library report given above, are often summarized in per cents?

7. A grammar school has a membership of 300 children. How many children are absent when 3% are absent? What is the percentage of absences?

8. What is the percentage of absences when, from a school of 500 members, 4% are absent? When 6% are absent?

Notice that, in finding a percentage mentally, it is often convenient to point off two places in the number to find what 1 per cent equals, and then to multiply by the number of per cents given. 4% of 500 is found by multiplying 5 (that is, 5.00) by 4.

Name the percentages found by taking:

9. 2% of: 300; 600; 210; 430.

10. 3% of: 200; 600; 120; 330.

11. 4% of: 210; 220; 300; 2200.

12. 6% of: 300; 1200; 4000.

13. 7% of: 400; 4000; 3000; 5000.

14. A school that contained 450 pupils had its membership increased 2%. What was its new membership?

15. What number equals 200 increased 4%? 500 increased 2%? 300 increased 7%?

16. From my savings amounting to $400, I spent 5%. How much money have I left?

17. What number equals 200 diminished 4%? 300 diminished 3%? 400 diminished 2%?

II

[With pencil.]

1. A city containing 54,000 inhabitants increased in population 12% in five years' time. What was its population after the increase?

2. What would have been the population of the city if, instead of increasing, it had decreased 12%?

In percentage, the number upon which a percentage is based is sometimes spoken of as the **base**; the given number of hundreds to be taken, as the **rate**, or the **rate per cent**; and the answer found by taking the given number of hundredths, as the **percentage**.

In the first problem under section II, 54,000 is the base; 12% is the rate, or the rate per cent; and 54,000 × .12, or 6480, is the percentage.

3. Find: 7% of 1940; 12% of 46,500; 18% of 104,725. (Label the percentage in each problem.)

4. Name the percentage found by taking:

2% of 450.
3% of 290.
4% of 720.
5% of 938.
6% of 198.
4% of 356.
5% of 784.
3% of 875.
4% of 1475.
3% of 7560.
5% of 8450.
6% of 9835.

5. In a recent year, of the 9,107,000 children in the United States between the ages of 10 and 14 years, 88% were attending school. Find the number that were attending school.

6. The city population of 30,797,000 in the United States increased in ten years 38%. How many people were then living in the cities?

7. Increase 14,780, 3 per cent. What is the amount?

8. What is the amount when 1225 is increased 4%? When 72,500 is increased 11%? When 81,150 is increased 16%?

9. In a recent year, out of 12,400,000 bales of cotton raised in the United States, 60% were exported to Europe. This left how many bales for use in the United States and in parts of the world other than Europe?

10. When 5400 is diminished 2%, what is left?

11. What is left when 9740 is diminished 3%? When 80,200 is diminished 8%? When 4,000,000 is diminished 1%? When 1,250,000 is diminished 5%?

22. The Fractional Part in Finding a Percentage

In solving many problems in percentage, it saves time if the fractional equivalents for given per cents are known. Exercises I and II below should be thoroughly mastered.

I

1. How many halves in a unit or whole? How many fourths? How many hundredths? How many per cent?

2. How can the equivalent per cent for $\frac{1}{2}$ be found? For $\frac{1}{5}$? For $\frac{8}{10}$?

Express as per cents:

3. $\frac{1}{2}$. $\frac{1}{10}$. $\frac{1}{5}$. $\frac{8}{10}$.
4. $\frac{2}{5}$. $\frac{4}{5}$. $\frac{1}{4}$. $\frac{3}{4}$.
5. $\frac{3}{5}$. $\frac{1}{8}$. $\frac{3}{8}$. $\frac{5}{8}$.
6. $\frac{7}{8}$. $\frac{1}{3}$. $\frac{2}{3}$. $\frac{4}{3}$.
7. $\frac{5}{6}$. $1\frac{1}{3}$. $\frac{1}{9}$. $\frac{1}{7}$.
8. $\frac{1}{20}$. $\frac{1}{25}$. $\frac{1}{50}$. $\frac{9}{10}$.
9. $1\frac{1}{2}$. $\frac{5}{4}$. $1\frac{1}{4}$. $1\frac{1}{8}$.

10. What per cent is equivalent to 2 times a number? To $2\frac{1}{4}$ times?

II

The foreign-born population of a city was 25% of the entire population. What part of the population was foreign-born?

$25\% = \frac{25}{100}$. $\frac{25}{100}$, reduced to lowest terms, $= \frac{1}{4}$.

1. Explain how to find the fractional equivalent for 75%. For $33\frac{1}{3}\%$. For 150%.

Give the fractional equivalents for:

2. 10%. 20%. 50%. 150%. 70%.
3. 75%. 40%. 120%. 30%. 90%.
4. $12\frac{1}{2}\%$. $62\frac{1}{2}\%$. 60%. $37\frac{1}{2}\%$. 125%.
5. $87\frac{1}{2}\%$. $33\frac{1}{3}\%$. $66\frac{2}{3}\%$. $16\frac{2}{3}\%$. $133\frac{1}{3}\%$.
6. $83\frac{1}{3}\%$. 80%. $11\frac{1}{9}\%$. $14\frac{2}{7}\%$. $166\frac{2}{3}\%$.

III

[Without pencil.]

Using fractional equivalents for the given per cents, find:

1. 10% of 300.
2. 25% of 800.
3. 12½% of 160.
4. 33⅓% of 900.
5. 16⅔% of 18,000.
6. 20% of 10,000.
7. 12½% of 8000.
8. 37½% of 8000.
9. 20% of 25,000.
10. 40% of 25,000.
11. 40% of 20,000.
12. 33⅓% of 6000.
13. 66⅔% of 6000.
14. 66⅔% of 9000.
15. 16⅔% of 12,000.
16. 83⅓% of 12,000.
17. 10% of 11,000.
18. 70% of 11,000.
19. 30% of 5000.
20. 12½% of 2400.
21. 62½% of 2400.
22. 87½% of 2400.
23. 62½% of 4000.
24. 87½% of 4000.

Find:

[With pencil.]

25. 16⅔% of 67,200.
26. 20% of 75,500.
27. 60% of 75,500.
28. 37½% of 87,520.
29. 66⅔% of 33,900.
30. 125% of 68,000.
31. Increase 5750, 10%.
32. Increase 448, 12½%.
33. Increase 2880, 50%.
34. Increase 26,500, 20%.
35. Decrease 40,600, 33⅓%.
36. Decrease 976,000, 62½%.
37. Find the difference between 125% of 2480 and 110% of 3000.

IV

A city government spends .005 of its income on the care of public buildings. What per cent does it spend for this purpose?

Just as 5 mills or .005 of a dollar is called ½¢, .005 of any quantity may be regarded as ½ of $\frac{1}{100}$ of it, or as ½ per cent.

.005 = $\frac{5}{10}$ of 1 per cent, or ½ per cent.

To express a decimal of more than two places as per cent, name the part beyond hundredths as a part of one per cent.

.0025 = $\frac{25}{100}$ of 1 per cent. $\frac{25}{100}$ of 1 per cent = $\frac{1}{4}$ of 1%, or $\frac{1}{4}$%.

.00125 = $\frac{125}{1000}$ of 1 per cent. $\frac{125}{1000}$ of 1 per cent = $\frac{1}{8}$%.

.0475 = $4\frac{75}{100}$ per cent, or $4\frac{3}{4}$%.

Express as per cents:

1. .002
.008
.125

2. .025
.0125
.0825

3. .001
.015
.006

4. .0075
.0375
.05125

To what decimal is $\frac{1}{2}$% equivalent?

$\frac{1}{2}$% = $\frac{1}{2}$ of 1 per cent. Since 1 per cent = .01, $\frac{1}{2}$% = $\frac{1}{2}$ of .01, or .005.

Write in decimal form:

5. $\frac{1}{5}$%.
$\frac{1}{4}$%.
$\frac{1}{8}$%.

6. $2\frac{1}{2}$%.
$4\frac{1}{4}$%.
$3\frac{1}{8}$%.

7. $\frac{2}{5}$%.
$\frac{3}{4}$%.
$\frac{8}{10}$%.

8. $3\frac{2}{5}$%.
$5\frac{3}{4}$%.
$4\frac{8}{10}$%.

*9. $2\frac{5}{8}$%.
$3\frac{3}{8}$%.
$4\frac{7}{8}$%.

Change per cents to decimal form whenever convenient, and find answers:

[With pencil.]

10. $\frac{1}{2}$% of 4500 = ?
11. $\frac{1}{4}$% of 8750 = ?
12. $\frac{2}{5}$% of 25,375 = ?
13. $2\frac{1}{2}$% of 62,400 = ?
14. $4\frac{8}{10}$% of 50,000 = ?
15. $1\frac{3}{4}$% of 2000 = ?
16. $1\frac{1}{8}$% of 88,000 = ?
*17. $1\frac{5}{8}$% of 24,720 = ?
*18. $2\frac{7}{8}$% of 480,640 = ?
*19. $5\frac{3}{8}$% of 500,000 = ?

23. Expressing a Comparison as a Per Cent

I

Out of 25 games played by a baseball nine, 15 were won. What per cent was won?

15 games = $\frac{15}{25}$, or $\frac{3}{5}$, of the games played. The number of games won equaled $\frac{3}{5}$ of 100%, or 60%.

[Without pencil.]

1. A boy solved 12 problems out of 18 correctly. What part of the 18 did he solve correctly? What per cent?

2. A pupil is absent 20 days out of 200 in a school year. What part of the school year is he absent? What per cent?

3. 7 is what part of 21? What per cent?

4. 30 is what part of 40? What per cent?

5. What per cent:

Is 5 of 10?
Is 4 of 16?
Is 8 of 40?
Is 2 of 12?
Is 20 of 30?
Is 40 of 50?

6. A football team wins 6 games out of 10. What is the per cent of games won?

From the following football records, find the per cent of games won in a year by each team:

7. U.S. Army Eleven (West Point) played 5 games; won 3.

8. U.S. Navy Eleven (Annapolis) played 8 games; won 4.

9. Carlisle Indians played 12 games; won 8.

10. Yale played 10 games; won 8.

11. Harvard played 10 games; won 10.

12. What is the per cent of games lost when a football team wins 7 games and loses 3?

From the following record, find for each team first the total number of games played and then the per cent lost:

13. Cornell won 8 games and lost 2 games.

14. Chicago won 5 games and lost 1 game.

15. Michigan won 6 games, lost 1 game, and tied 2 games.

16. Princeton won 7 games and lost 1 game.

17. Pennsylvania won 9 games, lost 1 game, and tied 1 game.

Express as a per cent the ratio of:

18. 12 to 48.
19. 18 to 36.
20. 50 to 60.
21. 70 to 80.
22. 12 to 30.
23. 18 to 30.
24. 15 to 45.
25. 60 to 90.
26. 300 to 900.
27. 600 to 800.
28. 200 to 1400.
29. 125 to 500.

II

(1) A school with a membership of 425 had an attendance of 391 pupils on a stormy day. What was the per cent of attendance?

(2) The number of books in a village library was increased from 850 volumes to 1020. What was the per cent of increase?

(1)

391 pupils = $\frac{391}{425}$ of 425 pupils.
$\frac{391}{425}$ = 391 ÷ 425, or .92.
The attendance was .92, or 92%.

(2)

1020 vol. − 850 vol. = 170 vol.
170 vol. = $\frac{170}{850}$ of 850 vol.
$\frac{170}{850}$ = .20.
The increase was .20, or 20%.

[With pencil.]

1. $5850 is what part of $9750? What per cent?

2. Express as a per cent the ratio of 243 to 540. Of 2520 to 12,000. Of 12,600 to 45,000.

3. Out of an income of $1400 a year a family spends $560 for food. This is what per cent?

4. Find the per cent of the total income spent for food when $625 out of $2500 is spent? When $850 out of $5000 is spent?

5. Out of an income of $1500 a family spends $65 for recreation and $42 for church and charity. Find the approximate per cent spent for each.

6. Copy and complete the following table writing within the parentheses the approximate per cent each item has to the total income.

Income	Food	Clothing	Savings	Rent
$900	$420 (47%)	$110 (12%)	$24 (3%)	$150 (17%)
$1200	$480 (%)	$155 (%)	$55 (%)	$228 (%)
$1500	$540 (%)	$200 (%)	$75 (%)	$350 (%)
$1800	$600 (%)	$250 (%)	$120 (%)	$420 (%)
$2100	$600 (%)	$275 (%)	$225 (%)	$480 (%)
$2400	$660 (%)	$300 (%)	$300 (%)	$540 (%)
$3000	$700 (%)	$340 (%)	$500 (%)	$600 (%)

7. The difference between 7500 and 9000 is what per cent of 7500?

8. In ten years, the wealth in the United States has increased from $850 per person to $1165. Find the per cent of increase.

*9. The total area of the United States is 3,743,306 sq. mi. Of this area, continental United States covers 3,026,789 sq. mi., and the outlying possessions cover 716,517 sq. mi. What per cent of the total is in each? (Carry quotients to three decimal places only, then give the approximate per cent.)

24. The Equation in Percentage

I. THE MEANING OF AN EQUATION

[Without pencil.]

1. Which is greater, 2 ft. 6 in., or 30 in.? $\frac{4}{5}$ of 25, or 2 times 10?

An expression of equality between two quantities is called an **equation.**

The expression 2 ft. 6 in. = 30 in. is an equation; so also is the expression $\frac{4}{5}$ of 25 = 2 × 10.

The quantities joined together to form an equation are called the **members** of the equation.

In the equation 2 ft. 6 in. = 30 in., 2 ft. 6 in. is one member; 30 in. is the other.

The members of an equation must be equal in value.

Find the missing number in each of the following equations:

2. $3 + ? = 7.$
3. $\frac{1}{2} = \frac{3}{8} + ?$
4. $12 + 8 = ? + 4.$
5. $4 = \frac{?}{8}.$
6. $4 \times ? = 28.$
7. $8 - ? = \frac{1}{2}$ of 10.
8. $\frac{24}{?} = 15 - 7.$
9. $72 \div ? = 8.$
10. $25 \div ? = \frac{1}{4}.$
11. $4 - 1\frac{1}{2} = ? + \frac{1}{4}.$
12. $8 \div \frac{1}{2} = 4 \times ?$
13. $? \div 4 = \frac{3}{8} \times 3.$

When there is an unknown quantity in an equation, it is often convenient to use a letter to stand for it. Any letter may be used, but the one most frequently chosen is x.

$3 + ? = 8$ is written $3 + x = 8$. $3 \times ? = 27$ is written $3x = 27$.
$12 - ? = 7$ is written $12 - x = 7$. $\frac{?}{2} = 12$ is written $\frac{x}{2} = 12$.

Notice that the expression $3x$ is equivalent to 3 times x and that the expression $\frac{x}{2}$ is equivalent to $x \div 2$, or $\frac{1}{2}$ of x.

Find the value of x in each of the following equations:

14. $9 + x = 14.$
15. $12 - x = 8.$
16. $18 = 7 + x.$
17. $24 = 30 - x.$
18. $x + 4 = 2 \times 6.$
19. $7 + x = 10 + 2.$
20. $15 - x = 4 \times 3.$
21. $7x = 35.$
22. $10x = 30 + 10.$
23. $50 = 2x.$
24. $4 \times 6 = 3x.$
25. $12x = \frac{3}{4} \times 48.$

II. CLEARING AN EQUATION OF A FRACTION

From the equation $\frac{x}{2} = 5$, we know that, since $\frac{1}{2}$ of the number represented by x is 5, the whole number ($\frac{2}{2}$) must be two times 5, or 10. Here, the value of x is found by multiplying the second member of the equation by the denominator of the first member.

[Without pencil.]

1. Explain how the value of x is found in the equation $\frac{x}{8} = 7$. In the equation $\frac{x}{4} = 8$. In $\frac{x}{12} = 2$. In $10 = \frac{x}{5}$. In $300 = \frac{x}{2}$.

2. $\frac{x}{2} = 25;\ x = ?$
3. $\frac{x}{20} = 7;\ x = ?$
4. $\frac{x}{10} = 15;\ x = ?$
5. $18 = \frac{x}{2};\ x = ?$
6. $21 = \frac{x}{3};\ x = ?$
7. $30 = \frac{x}{12};\ x = ?$

III

What is the value of x when $\frac{1}{100}$ of x is 14? When $\frac{3}{100}$ of x is 30?

$\frac{1}{100}$ of $x = \frac{x}{100}$.

Then, $\frac{x}{100} = 14$.

$x = 14 \times 100$.

$x = 1400$.

$\frac{3}{100}$ of $x = \frac{3x}{100}$.

Then, $\frac{3x}{100} = 30$.

$3x = 30 \times 100$.

$3x = 3000$.

$x = 1000$.

[With pencil.]

Find the value of x in the equations below, following the form given in the second solution above, by writing out a series of equations for each problem:

1. $\frac{3x}{4} = 6$.
2. $\frac{5x}{10} = 10$.
3. $20 = \frac{2x}{8}$.
4. $90 = \frac{3x}{10}$.
5. $33 = \frac{11x}{100}$.
6. $\frac{3}{5}$ of $x = 30$.
7. $\frac{7}{8}$ of $x = 1400$.
8. $300 = \frac{3}{10}$ of x.
9. $150 = \frac{5}{100}$ of x.

IV. USING THE EQUATION IN SOLVING PROBLEMS

By using the equation, all of the various types of problems in percentage may be solved by one formula:

$$\text{Base} \times \frac{\text{Rate}}{100} = \text{Percentage}.$$

(1) Out of my earnings amounting to $900, I save 5%. What is the percentage that I save?

(2) When, out of earnings amounting to $875 I save $70, what per cent do I save?

(1)

Let x = the percentage.

Then, $900 \times \frac{5}{100} = x$.

$$\overset{9}{\cancel{900}} \times \frac{5}{\cancel{100}} = x.$$

$x = 45$

The percentage saved is $45.

(2)

Let x = the rate per cent.

Then, $875 \times \frac{x}{100} = 70$.

$\frac{875x}{100} = 70$.

$875x = 7000$.

$x = 8$.

The part saved is 8%.

[With pencil.]

Solve, using the equation:

1. In buying a house for $4500, I pay 12% down. What amount do I pay down?

2. What is 11% of $7400? 9% of $16,000? 114% of 3000?

3. In buying a house for $5100, I pay $1700 down. This is what per cent of the cost?

4. Express as a per cent the relation of 350 to 1400. Of 750 to 4500. Of 14,500 to 72,500.

5. A boy earns $24.75 and saves $16.50, what per cent of his money does he save?

6. Find the per cent saved when, out of earnings amounting to $75, $37.50 is saved. When out of $120, $72 is saved.

7. Out of an income of $125 each month a young man puts $45 in a savings bank. How much money does he deposit in a year? This is what per cent of his income?

8. By moving into the country a family reduces its expense for rent from $420 a year to $240 a year. What per cent of their total income of $1500 is the rent in each case? What is the difference in the per cent?

9. Out of an income of $190 a month, a family spends 92%. They increase their income 10%, but keep their expenses the same. This increase allows them to save how much more money each year than they were able to save out of their former income?

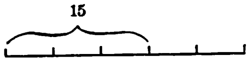
25. Finding the Number upon which a Percentage is Based

I

In a spelling test, 15 words were correctly spelled. How many words were in the test, if the number correctly spelled was 60% of the entire number?

Since 60%, or $\frac{3}{5}$, of the entire number of words in the test was 15, $\frac{1}{3}$ of the number was $\frac{1}{3}$ of 15, or 5; and $\frac{5}{5}$, or the whole number, was 5 times 5, or 25.

This explanation may be shortened by first finding the ratio of 100% to the per cent given. Since 100% is $\frac{5}{3}$ of 60%, the whole number of words was $\frac{5}{3}$ of 15 words, or 25 words.



[Use pencil only when needed.]

1. Twenty per cent of a number is 12. Find the number in the shortest way.

2. Seventy-five per cent of a number is 30. Explain how the number is found without the use of a ratio. With the use.

3. Find 100% when 10% of a number is 7. When 50% of a number is 25. When $66\frac{2}{3}\%$ of a number is 40.

Find the whole number:

4. When $33\frac{1}{3}\%$ of it = 15.
5. When $16\frac{2}{3}\%$ of it = 9.
6. When $12\frac{1}{2}\%$ of it = 20.
7. When 30% of it = 21.
8. When 40% of it = 8.
9. When $37\frac{1}{2}\%$ of it = 60.
10. When 150% of it = 300.
11. When $166\frac{2}{3}\%$ of it = 150.
12. When $\frac{1}{2}\%$ of it = 4.
13. When $1\frac{1}{2}\%$ of it = 9.

14. In a test in arithmetic, 6 problems were correctly solved. How many problems were in the exercise, if the number correctly solved was 75% of the total number?

15. In a geography test marked $87\frac{1}{2}\%$, there were 7 questions correctly answered. How many questions were in the exercise?

16. A boy increased his savings 50%. He then had \$30. How much did he have before?

17. Out of the sum of money in my pocket book, I spend 25%. The amount left is \$3.00. What sum had I at first?

18. Find the number that, when increased $33\frac{1}{3}\%$, is 80. That, when decreased 20%, is 400.

II

Twenty-two per cent of a number is 462. What is the number?

SOLUTION BY ANALYSIS

22% of the number = 462.
1% = 462 ÷ 22, or 21.
100% = 21 × 100, or 2100.
The number is 2100.

SOLUTION WITH EQUATION

Let x = the number.
Then,

$$x \times \frac{22}{100} = 462.$$
$$\frac{22x}{100} = 462.$$
$$22x = 46{,}200.$$
$$x = 2100.$$

The number is 2100.

[With pencil.]

1. Eight per cent of a number is 376. Find the number.

2. Find the number of which 3% is 9840. Of which 12% is 150,000. Of which 106% is 3180.

3. A man has on hand 15% of the amount of money required to build the house he is planning. How much is the house to cost if the amount he has on hand is $675?

4. A boy has his choice between the purchase of a motor boat and a motor cycle. The motor cycle costs $175. This is 70% of the cost of the motor boat. What is the price of the motor boat?

5. A last year's model of a certain kind of automobile can be bought for $1575. This is 75% of the price of this year's model. Find the price of this year's model.

6. Find the sum of money of which 25% is $410. Of which 40% is $7500. Of which 150% is $42,000.

7. A farm that cost $12,600 is improved and resold. The cost of the farm is 90% of the amount for which it is sold. At what price is it sold?

8. A number increased 20% equals 720. What is the number?

Since a number increased 20% is equal to 120% of the original number, in solving this problem the equation is: $x \times \frac{120}{100} = 720$.

9. Find the number that increased 50% equals 7650. That decreased 25% equals 3750.

10. Find the wholesale price of a bicycle sold at retail for $45.00 at an advance of 20%. Of a phonograph sold at retail for $25.30 at an advance of 10%. Of a Gloucester hammock sold at retail for $15.75 at an advance of 25%.

Find the number of which:

11. 3% = 3750.
12. 25% = 875.
13. 37½% = 1545.
14. 66⅔% = 1470.
15. 150% = 3375.
16. 200% = 1960.
17. 108% = 3240.
18. 133⅓% = 4880.
19. 75% = 150.6.
20. ½% = 1.75.
21. 1½% = 10.5.
22. 104⅛% = 416.5.

23. Find the number that when increased 8% = 21,600. That when increased 33⅓% = 3680. That when increased 60% = 1500.

24. Find the number that when decreased 5% = 2850. That when decreased 12½% = 3675. That when decreased 10% = 1512.

*25. What number increased ½% = 4824?

*26. Find the number that decreased 37½% equals 2500 increased 125%.

26. Test and Supplementary Practice

Test your accuracy in percentage by solving the problems in Exercise I. If, in this work, you fall below the standard for your class, review the work on percentage, then solve the problems in Exercise II.

I

[With pencil.]

1. Find 1½% of $1435.
2. To 4872, add 37½%.
3. From 947,900 take 66⅔%.
4. Out of $4720, $645 is spent. What per cent is spent?

5. Express as a per cent the ratio of 625 to 500.
6. 14% of a number is 294. Find the number.
7. Find the number that increased 6% equals 53,000.
8. Find the number that decreased 40% equals 1980.
9. $37\frac{1}{2}\%$ of 264,000 is what per cent of 322,500?
10. $3\frac{1}{2}\%$ of 1440 is $16\frac{2}{3}\%$ of what number?

II

[With pencil.]

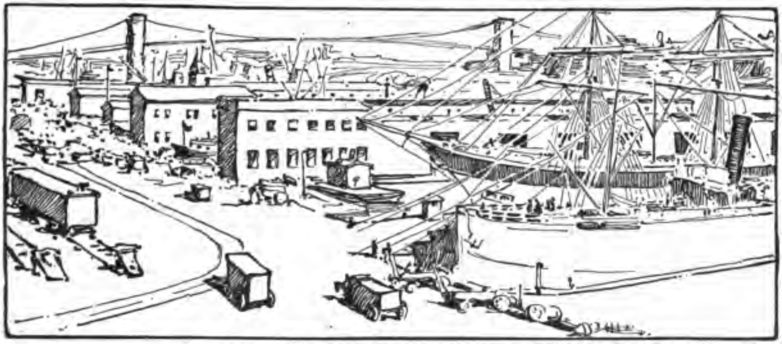
Find answers:

1. 6% of 18,400 = ?
2. $12\frac{1}{2}\%$ of 9760 = ?
3. $87\frac{1}{2}\%$ of 4968 = ?
4. 107% of 870 = ?
5. 120% of 5400 = ?
6. $\frac{1}{2}\%$ of 48,000 = ?
7. $2\frac{1}{2}\%$ of 8402 = ?
8. $\frac{50}{125}$ = ? per cent.
9. $\frac{45}{360}$ = ? per cent.
10. $\frac{620}{124}$ = ? per cent.
11. $\frac{720}{630}$ = ? per cent.
12. 4% = 2800; 100% = ?
13. $12\frac{1}{2}\%$ = 47; 100% = ?
14. $62\frac{1}{2}\%$ = 510; 100% = ?
15. 120% = 5796; 100% = ?
16. $\frac{1}{8}\%$ = 40; 100% = ?
17. $1\frac{1}{2}\%$ = 18; 100% = ?
18. $103\frac{1}{2}\%$ = 3312; 100% = ?

19. 75% of 4400 is what per cent of 13,200?
20. $1\frac{1}{2}\%$ of 4000 is $66\frac{2}{3}\%$ of what number?
21. Increase: 5600, $12\frac{1}{2}\%$; 7500, 40%.
22. Increase: 560, 6%; 4500, 4%; 500, $3\frac{1}{2}\%$; 670, $2\frac{1}{4}\%$.
23. Find the number that increased 5% equals 26.25.
24. Decrease: 475, 10%; 57.78, $16\frac{2}{3}\%$; 397.68, $1\frac{1}{2}\%$.
25. Find the number that decreased 25% equals 2736.

CHAPTER IV. HOW BUSINESS IS DONE

27. What is Meant by Business



Most articles that we purchase at a retail store pass through many hands before we buy them. Take, for example, such an article of clothing as a boy's woolen sweater. The wool for the sweater is produced on a sheep farm or ranch, is bought by an agent, and is then sent by rail or water to a factory where it is made into yarn. The yarn is then sold to another factory where it is knitted into the garment. From the latter factory, the sweater is sold with dozens of others to a wholesale dealer, who in turn sells it to a retail dealer, to be sold by him to a customer. It is the conducting of such transactions that is called **business**.

The four great classes of business men are: (1) the **producers,** including those who manage farms, mines, and factories; (2) the **carriers,** who are engaged in the transportation of goods by road, rail, and water; (3) the **merchants,** both wholesale and retail; and (4) **bankers.**

Name one or more business firms or companies in your locality engaged in: (1) the dairy business; (2) manufacturing; (3) a wholesale business; (4) a retail business; (5) the express business; (6) the railway business. Tell to which of the four classes each belongs.

28. Selling Goods at Retail

A business man has many expenses to meet. A retail merchant, for example, must buy goods to sell; he must pay wages to his clerks and other employees; and he must meet expenses for rent, heat, light, insurance, advertising, freight, and the delivery of goods to customers. Furthermore, he must see that the money invested in his business yields a fair amount of interest. To make his business profitable, therefore, a merchant must charge enough for his goods not only to cover their cost, and to pay for the running expenses for the business, but also to leave a balance after all expenses have been paid.

I

[Use pencil only when needed.]

1. A jeweler sells boys' watches at \$3.00 each. Of this amount 75% goes to pay the wholesale merchant, and 18% goes toward the running expenses of the store. What is the jeweler's profit on each watch? On each dozen watches?

2. Pocket knives bought at wholesale for \$4.00 a dozen are sold at retail at an advance of 50%. At what price is each knife sold?

3. After running a candy store for several months, a young woman found that it took $16\frac{2}{3}\%$ of the amount that she received for the candy to pay the clerk hire and other running expenses of the store. At that rate, what did she reckon as the cost of selling a box of candy for which she received 30¢? For which she received 60¢?

4. The young woman wanted to find which kind of candy brought her the highest per cent of profit. On one grade of chocolate, which

she bought at 50¢ a pound, she found that she was making a net profit of 10¢ on a pound. This was what per cent of the cost?

5. On chocolates of another grade, bought for 54¢ a pound, she made a net profit of 9¢ a pound. What was her per cent of gain on this grade of chocolates?

6. On mixed candies bought for 25¢ a pound, she made a net gain of 10¢ a pound. On which one of the three kinds of candy did she make the highest per cent of profit?

7. A dry-goods merchant found that the expense of running his store came to 20% of the amount received for the goods sold. At this rate, what should be counted as the expense of handling a suit selling for $35.00? Of handling a suit selling for $50.00?

8. The merchant buys a suit for $25, which he sells for $40. After taking out the cost of the suit and 20% of the selling price to pay the running expenses of the store, the dealer makes a profit of how many dollars?

9. After allowing 20% of the selling price for the running expenses of the store, how many dollars net profit does the dealer make on a suit bought for $20 and sold for $30? On a suit bought for $30 and sold for $45?

10. A girl's cloak is bought for $12 and sold for $18. After allowing $3 for the running expenses of the store, how many dollars of profit are there? This profit is what per cent of the cost of the overcoat? What per cent of the selling price?

[With pencil.]

11. A furniture dealer buys a dining-room table at wholesale for $20.25, which he sells at retail at a price that brings him a net profit of $6.75. The profit is what per cent of the price paid for it at wholesale?

12. The cost of handling the furniture is 25% of the amount received. At this rate, what must be reckoned as the selling expense of a sideboard sold for $35.50? Of an easy chair sold for $17.75?

13. The following prices are taken from the boys' department of a clothing store. Find the missing items.

Article	Cost at wholesale	Selling expense 25% of selling price	Selling price	Net profit	Net profit as per cent of selling price
(*a*) Boys' Norfolk Suits	$9.60 each	$4.00	$16.00	$2.40	15%
(*b*) Corduroy Suits....	7.50 "	?	12.00	?	?
(*c*) Boys' Overcoats...	10.00 "	?	18.00	?	?
(*d*) Skating Coat......	5.00	?	10.00	?	?
(*e*) Black Rubber Coat	2.50	?	4.50	?	?
(*f*) Rubber Hat.......	0.55	?	1.00	?	?
(*g*) Boys' Shoes.......	3.20	?	5.00	?	?
(*h*) Sweaters..........	54.00 a doz.	?	7.50	?	?
(*i*) Tweed Caps......	9.00 " "	?	1.20	?	?
(*j*) Neckties.........	4.80 " "	?	0.75	?	?

*14. A merchant's sales for a year came to $42,486; his running expenses, to $10,206. The cost of his goods at wholesale was $27,052. His net profit was what per cent of his sales? Of the cost of his goods at wholesale?

II. Offering a Discount

To attract trade or to get rid of an overstock of goods, merchants often sell their goods at a given per cent less than the marked price. When goods are sold in this way, the amount thrown off from the marked price is often spoken of as a **discount**; and the price after the discount has been made, as the **net price**.

Cut from newspapers several advertisements of discount sales and use them in problems.

[Without pencil.]

1. Shoes marked $7.50 are offered for sale at a discount of 20%. At what price should they be sold?

The discount = 20%, or $\frac{1}{5}$, of $7.50; the selling price = $7.50 less the discount.

2. Gloves are offered for sale at a discount of 10%. What is the

selling price of a pair marked \$2.00? Of a pair marked \$2.50? Of a pair marked \$3.00?

3. To get rid of a season's left-over stock of furs, a dealer offers his entire stock at a discount of $33\frac{1}{3}\%$. At what price will he sell a muff marked \$27? A fur-lined overcoat marked \$120? A fur coat marked \$150?

4. To make room for new summer goods, a merchant offers his winter stock at reduced prices. What is the rate of discount on dress goods marked \$2.00 a yard and selling for \$1.50 a yard? On cloaks marked \$48.00 and selling for \$36.00? On dresses marked \$25.00 and selling for \$15.00?

5. Find the rate of discount on each article named in the following advertisement:

Reliable Linens at Remarkably Low Prices

SATIN DAMASK NAPKINS, 20 inches square, fine Irish make.
Former price, \$7.50 a dozen. Special price, per dozen...... **\$6.00**
22-inch Scotch make. Former price, \$9.00 a dozen, at....... **\$8.00**

SATIN DAMASK PATTERN CLOTHS, border all around, good quality, beautiful designs, two sizes, as follows:
Size 2 x 2 yards. Former price, \$12.00 each, special at.... **\$9.00**
Size 2 x 2½ yards. Former price, \$6.00 each, special at.. **\$4.50**
20-inch Napkins (to match). Former price, \$9.00 a dozen.... **\$6.00**

[Use pencil when needed.]

6. A sweater costing at wholesale \$4.00 is marked to sell at a price 50% greater than the cost at wholesale, and is then sold at a discount of 20%. At what price is it sold?

7. Find the selling price of a suit of clothes bought at wholesale for \$24.00, marked to sell at an advance of $33\frac{1}{3}\%$, and then sold at a discount of 10%.

[With pencil.]

8. A merchant going out of business offers his sporting goods at a discount of $33\frac{1}{3}\%$. How much would be paid for 4 tennis rackets

marked $4.25 apiece, 1 dozen tennis balls at $6.60 a dozen, and 1 basket ball for $6.25?

9. House furnishings are offered for sale at a discount of 25%. At what price should a kitchen range marked $50.00 be sold? A fireless cooker marked $18.00? A vacuum cleaner marked $75.00?

10. Find the difference in the rate of discount on a bicycle marked $35.00 and selling for $27.50 and one marked $40.00 and selling for $32.00.

11. Not all discount sales are honest. A dealer marks a suit case for sale at $15.75 with a discount of 20%. How much more is charged by this dealer than by another who sells the same kind of suit case for $10.50 without a discount?

*12. Curtains are bought at wholesale for $30 a dozen pairs. At what price must each pair be marked so as to be sold at an advance equal to 20% of the wholesale price, after a discount of 33⅓% has been made?

29. Selling Goods at Wholesale

I

If you were to visit a wholesale house, you would find large quantities of goods and only a few, if any, customers there. The reason for this is that most of the selling is done by traveling salesmen, or agents, who carry samples of goods to retail merchants and get their orders for goods in this way.

The agents sometimes receive fixed salaries, and sometimes a percentage of their sales. If, for example, a man sold $70,000 worth of goods, his salary might be $1400 irrespective of the amount sold; or it might be 2% of the sales. In the latter case, if he sold $50,000 worth of goods, he would receive $1000 as his pay; if he sold $80,000 worth, he would receive $1600.

A percentage of the proceeds received for the transaction of business is called a **commission**.

[Use pencil only when needed.]

1. One of the large phonograph companies in this country pays its agents 5% of the catalogue price for each machine sold. What commission does an agent receive on a machine catalogued at $40? On one catalogued at $60?

After an agent's commission has been taken out of the selling price, the amount left is called the **net proceeds.**

2. Find the net proceeds received by the phonograph company on each 40-dollar machine. On each 60-dollar machine.

3. An agent sold a carload of the phonographs in Chicago. It contained 50 machines marked $15; 50 marked $25; 90 marked $35; 165 marked $45; and 35 marked $60. What was the agent's commission on the carload?

4. The agent paid $60 for freight on each carload of machines. What was his profit in a year when he sold 5 carloads of the same value as the one described in problem 3?

*5. What was the total sum of money that the agent should have sent during the year to the phonograph company?

6. What are the net proceeds received by a wholesale house from a sale of goods amounting to $15,750, sold on a commission of $2\frac{1}{2}$%?

*7. Find the amount of goods that it is necessary for an agent to sell on a commission of $1\frac{3}{4}$% in order to clear in a year $3500.

II

Wholesale dealers, to encourage customers to buy in large quantities and to pay their bills promptly, frequently offer one discount for large orders and another discount for cash or for payments made within a short period of time.

When two or more discounts are made, each discount is deducted separately.

(1) What amount is due a wholesale grocer on a bill amounting to $1520 after discounts of 10% and 5% have been made?

10% discount = $152.00. This leaves as the amount due $1368.00. 5% discount on $1368.00 = $68.40. The amount due is $1368.00 − $68.40, or $1299.60.

In making a number of discounts, it is often convenient to find one discount to which they are equivalent.

(2) To what single discount is a discount of 25% and 10% equal?

100% − 25% = 75%. 10% of 75% = 7½%. The two discounts equal 25% + 7½%, or 32½%.

[Use pencil only when needed.]

1. Find the discount that is equivalent to a double discount of 20% and 10%. Of 15% and 20%.

2. What sum is due a wholesale dry-goods merchant on a bill for $872.00 after discounts of 12½% and 10% have been deducted?

3. A retail merchant ordered from a wholesale clothing house 2 dozen boys' suits at $7.25 apiece and 4 dozen suits at $9.50 apiece. What sum was due the clothing house after discounts of 5% and 8% had been made?

4. A double discount of 20% and 5% is how much less than a single discount of 25%?

5. A shoe dealer bought from a wholesale house 8 doz. pairs of tan shoes at $4.20 and 6 doz. pairs at $5.00. How much more must he pay for the shoes if he receives two discounts, one of 10% and the other of 5%, than he would have to pay if a single discount of 15% were offered?

*6. Three discounts are made on a bill, one of 15%, another of 20%, and the other of 5%. To what single discount are they equivalent?

*7. Find the difference in the amounts deducted from a bill for $2478 when a single discount of 20% is made and when discounts of 10%, 8% and 2% are made.

30. The Manufacture and Sale of Clothing

I. The Cost of a Suit of Clothes

[With pencil.]

The following is a study of the manufacture of a boy's suit of clothes selling at retail for $17.

1. The suit required $3\frac{1}{4}$ yd. of woolen goods bought directly from a factory at $1.30 a yard. The linings and other material used in the suit came to $2.02. Find the cost of the material used.

2. The expense for labor in the manufacture of the suit was as follows: for sponging, examining, and cutting, $.06; for sewing and finishing the coat, $1.40; for sewing and finishing the trousers, $.60; for sewing and finishing the vest, $.46; general factory expense, $.18. How much did these items cost?

3. The cost of selling, and other expenses not reckoned in problems 1 and 2, came to $1.00 a suit. The total cost of manufacturing and selling the suit was how much?

4. The manufacturer sold the suit with others to a retail dealer for $144 a dozen, less a discount of 10%. For how much he did sell the suit? What was his profit in dollars and cents?

*5. What per cent of the retail price ($17) went to the manufacturer? What per cent to the retail dealer?

*6. What per cent of the $17 was the cost of the material used in the suit? The expense for labor?

II. THE COST OF A SWEATER

[With pencil.]

1. The cost of the material used in manufacturing sweaters of a certain quality came to $40.62 per dozen. The cost of labor per dozen was: for knitting, $5.934; for sewing and finishing, $0.7256. The other expenses in the mill came to $2.838 per dozen. Find the total cost of manufacture for each garment.

2. The sweaters were sold from the factory direct to retail dealers at $60.00 per dozen garments, less 12% discount. The manufacturer received how much per garment? What was his profit?

3. The retail merchant sold the sweaters at $8.75. Allowing 20% of the retail price for the cost of selling the sweater, what was the retail merchant's profit in dollars and cents on each sweater?

4. Misses' sweaters of a certain grade cost at the mill $37.185 per dozen. The cost of the material came to 65% of this amount; the cost of the labor, to 20%. This was how much for each sweater?

*5. The manufacturer sold the sweaters at $49.50 per dozen less a discount of 7%. The sweaters were sold at retail for $7.50 apiece. The manufacturer's profit was what per cent of the retail price?

III. THE COST OF A PAIR OF SHOES

[With pencil.]

The following problems show the cost of manufacturing and selling a pair of shoes retailing for $7.50 a pair.

1. The heaviest expense was the leather for the uppers. The amount required for the vamps, tips, and tops was 2.75 ft. at $0.55 per foot. This came to how much?

2. The tongues cost $.04; the linings, $.082; the back stays, $.022;

the eyelet face, \$.022. What was the total cost of the material, or stock, used in the uppers?

3. The expense for stock in the soles was as follows: for the insole, \$.22; for the counter, \$.024; for the outsole, \$.40; for the heel, \$.14; for the toplift, \$.08. How much did the material used in the sole cost?

4. The other supplies used in manufacturing the shoes came to \$.48. Find the total cost of the materials used.

5. The pair of shoes went through many departments in a factory. The cost of the labor in the cutting department was \$.22; in the stitching department, \$.24; in the lasting department, \$.114; in the finishing department, \$.12; in the treeing department, \$.135; in the packing department, \$.10. How much did the labor on each pair of shoes cost?

6. Besides the expense for stock and labor, the manufacturer had to meet such factory expenses as those for rent, heat, and light, and such selling expenses as those coming from the employment of a force of traveling men. These expenses amounted to \$.424 on each pair of shoes. Find the total cost of manufacturing and selling the shoes.

7. The manufacturer sold the shoes at \$4.75 a pair. What was his profit in cents?

8. The retail merchant bought the shoes direct from the manufacturer and sold them at retail for \$7.50 a pair. The expense incurred by the retail merchant in handling the shoes was 25% of the amount he received for them. How much money did he clear on the pair of shoes?

*9. What per cent of the retail price of the shoes was the cost of the stock (see problem 4)? The cost of the labor (problem 5)? The manufacturer's profit (problem 7)? The retail merchant's profit (problem 8)?

*10. Make a table summarizing the answers to problem 9.

31. Shipping Goods

Goods may be shipped by parcel post, by express, or by freight. Many commodities can be sent by any one of the three means; but, in general, small parcels not exceeding the value of from twenty-five to fifty dollars are sent by parcel post; valuable and perishable goods, and goods exceeding the dimensions and weight of articles that can be sent by parcel post that require prompt delivery, are sent by express; bulky commodities, such as goods in quantities, furniture, coal, lumber, and grain, are sent by freight.

I. PARCEL POST

Parcel post rates are determined by the distance a package is to be sent, and by its weight. Local rates are charged for all parcels delivered from the post office at which the parcel is mailed; first zone rates are charged for all other places within a radius of 50 miles of the post office; second zone rates (same as those for first zone) for all places within a radius of 50 to 150 miles. For other zone rates, see table that can be had without cost from any post office.

PARCEL POST RATES

WEIGHT	Local	First Zone	Second Zone
1 pound	$0.05	$0.05	$0.05
2 pounds	.06	.06	.06
3 pounds	.06	.07	.07
4 pounds	.07	.08	.08
5 pounds	.07	.09	.09
....	....	....	......
10 pounds	.10	.14	.14
....	....	....	......
20 pounds	.15	.24	.24

In weighing goods, all fractions of a pound are counted as a pound. Three fourths of a pound is counted as 1 lb.; $2\frac{1}{8}$ lb. are counted as 3 lb.

Parcels having a valuation of $5 or under may be insured for 3¢; those having a valuation of from $5 to $25, for 5¢. In case of loss of insured parcels through the mails, the post office pays the sender the value of the parcel.

[Without pencil.]

1. A parcel weighing 3½ lb. is sent at the local rate. Find the cost.

2. Find the cost of insuring and sending a parcel weighing 10 lb. by the first zone rate. Value of parcel, $15.

3. With the help of the partial table of rates given on page 68, or, better still, with the help of a complete table of rates obtained from your local post office, make and solve five problems on the cost of postage for parcels of different weights.

4. Make and solve at least three other problems. Include, in these, questions on both postage and insurance.

II. EXPRESS AND FREIGHT

Express and freight rates are both determined largely by the class of article to be shipped, by the distance the goods are to be sent, and by the method of packing used.

[Use pencil only when needed.]

1. The charge for sending a bicycle between two given places by express is 75¢ if the bicycle is crated, or twice as much if uncrated. The charge for expressing a dog in a crate the same distance is $1.13; without a crate, $1.50. Find the shipping expense saved by crating both the bicycle and the dog.

2. The express rates quoted between two places for a book weighing 1 lb. or less is 21¢; the parcel post rate between the two places is 5¢. In shipping 100 books each weighing less than a pound, the difference in the cost between the two ways is how much?

3. Charges on packages weighing over 100 pounds sent by express are made by the hundredweight. When the rate is $.60 a hundred, the cost of expressing an article weighing 150 lb. is $\frac{\$.60 \times 150}{100}$. Find the cost.

4. Find the cost, at 75¢ a hundred, of sending by express a trunk weighing 135 lb. A camping outfit weighing 240 lb.

RATES FROM CHICAGO

From Chicago to	Express per 100 lb.	1st-Class Freight per 100 lb.	2d-Class Freight per 100 lb.	3d-Class Freight per 100 lb.	4th-Class Freight per 100 lb.
New York, N.Y.	2.80	1.12½	.99	.75	.52½
Washington, D.C.	2.64	1.09½	.96	.72	.49½
Minneapolis, Minn.	2.36	.75	.52½	.50	.31½
St. Louis, Mo.	1.70	.45½	.37	.28$\frac{9}{10}$	.23$\frac{1}{10}$
Fort Worth, Tex.	4.40	2.09	1.76	1.45	1.33
Los Angeles, Cal.	9.95	4.25	3.69	3.06½	2.59

With the help of the table above, find the cost:

5. Of sending from Chicago to New York by express a package weighing 120 lb.

6. Of sending from Chicago to St. Louis by express a package weighing 75 lb.

7. Of sending from Chicago to Fort Worth by first-class freight a box of goods weighing 300 lb.

8. Of sending from Chicago to Los Angeles by fourth-class freight goods weighing 500 lb.

9. A box of goods weighing 250 lb. is to be sent from Chicago to Minneapolis. How much more will it cost to send it by express than by first-class freight?

10. With the help of the table, make and solve at least three other problems comparing the cost of sending goods from Chicago by express and by freight.

Freight rates are lower than express rates, but do not include the collection and the delivery of goods which is provided for in all large cities by express companies.

11. A box of books weighing 140 lb. is shipped by freight at a rate of 25¢ a hundredweight. The drayage to the freight depot at the place of shipment and the delivery at point of destination cost

50¢ each. The total amount paid is how much more than an express charge of 75¢ a hundredweight?

When freight is shipped by the ton, 2000 lb. is called a "**net**" ton; and 2240 lb., a "**gross**" ton.

12. At $2.30 a net ton, how much does it cost to ship a carload of brick weighing 50,000 lb.?

13. Find the cost, at $2.50 a gross ton, of shipping a carload of stone weighing 44,800 lb.

32. Progress Score [1]

With the help of these tests measure your half year's work in computing. Try to make 100 points on each test, counting for each correct answer the score given near the letter of the problem. If you fail to get the correct answer to a problem, use for practice the exercise of the same kind and letter on pages 304–313.

I. ADDITION TEST

Add:

[Copy problems only when necessary.]

A.	B.	C.
5	234	2134
(5) 8	(6) 546	(7) 475
7	783	3648
6	920	392
9	849	5486
4	387	14753
0	593	3268
8	698	479
7	437	1462
6		
9		
8		

D. $14\frac{5}{16}$	E. $25\frac{7}{12}$
(5) $12\frac{7}{16}$	(6) $14\frac{11}{12}$
F. $32\frac{3}{8}$	G. $17\frac{5}{9}$
(5) $14\frac{1}{4}$	(7) $8\frac{2}{3}$
H. $18\frac{2}{3}$	I. $42\frac{7}{8}$
(6) $12\frac{1}{4}$	(8) $59\frac{5}{6}$

[Write answer without copying problem.]

J. (6) $12.76 + $8.75 + $9.68 = ?

[Copy in column form and find answers.]

K. (8) $214\frac{1}{2} + 142\frac{5}{6} + 278\frac{7}{8} = ?$

L. (6) $4.75 + $16.38 + $49.75 + $24.16 + $7.92 + $64 = ?

M. (8) $1.75 + $0.18 + 24¢ + $6\frac{1}{4}$¢ + $5\frac{1}{2}$ mills + $1\frac{1}{4}$¢ = ?

N. (6) .125 + .475 + 3.14 + 24.8 + 3.165 = ?

O. (11) $8.24 + 6.14\frac{3}{5} + 8.72\frac{1}{2} + .14\frac{3}{4} + 1.2\frac{1}{8} = ?$

---

[1] See footnote, page 37.

II. SUBTRACTION TEST

[With pencil.]

A. 254364	B. 620040	C. $24\frac{1}{12}$	D. 25	E. $18\frac{1}{3}$
(5) $\underline{85039}$	(6) $\underline{162331}$	(6) $\underline{18\frac{1}{12}}$	(7) $\underline{8\frac{3}{5}}$	(8) $\underline{6\frac{2}{3}}$
F. $28\frac{7}{12}$	G. $16\frac{1}{6}$	H. $21\frac{5}{6}$	I. $322\frac{1}{4}$	J. $400.00
(6) $\underline{19\frac{1}{4}}$	(9) $\underline{8\frac{2}{3}}$	(7) $\underline{8\frac{3}{8}}$	(9) $\underline{140\frac{5}{6}}$	(5) $\underline{32.64}$

K. (8) $\$18 - 16\frac{1}{4}$¢ = ?

L. (6) $21.254 - 3.67 = ?$

M. (7) $48.2 - 1.96 = ?$

N. (11) $72.4\frac{3}{8} - 48.54 = ?$

III. MULTIPLICATION TEST

A. 8649	B. 6587	C. 2341	D. $48 \times \frac{3}{8}$.	E. $\frac{5}{6} \times 112$.
(5) $\underline{7}$	(6) $\underline{48}$	(6) $\underline{609}$	(3)	(7)
F. $42\frac{2}{3}$	G. 172	H. 360	I. $\frac{5}{6} \times \frac{4}{15}$.	J. $3\frac{3}{4} \times 2\frac{1}{2}$.
(9) $\underline{8}$	(11) $\underline{2\frac{3}{4}}$	(12) $\underline{32\frac{5}{8}}$	(5)	(8)

K. 16.42	L. .024	M. $42.28 \times .03\frac{3}{4} = ?$
(8) $\underline{18.3}$	(8) $\underline{.35}$	(12)

IV. DIVISION TEST

A. $8\overline{)69875}$	B. $71\overline{)179630}$	C. $69\overline{)26314}$	D. $1450\overline{)13006500}$
(4)	(5)	(6)	(9)

E. $24 \div \frac{3}{4}$.	F. $\frac{7}{8} \div \frac{2}{5}$.	G. $\frac{5}{6} \div 4$.	H. $7\frac{1}{2} \div 3$.	I. $1\frac{7}{8} \div 1\frac{1}{4}$.
(5)	(5)	(5)	(6)	(7)

J. (8) $52\overline{)194.64}$

K. (7) $4.5\overline{)13.635}$

L. (6) $.007\overline{)4.795}$

M. $.75\overline{)550}$
(8).

N. $3000\overline{)\$75}$
(8)

O. (11) $\dfrac{720 \times .04\frac{3}{4}}{2\frac{1}{2}} = ?$

33. Review of Percentage

[With pencil]

1. 4256 increased 4% = ?
2. 9762 increased $16\frac{2}{3}$% = ?
3. 842 increased 125% = ?
4. 795 decreased 6% = ?
5. 12964 decreased 40% = ?
6. $\frac{450}{5000}$ = ? per cent.
7. $\frac{720}{4320}$ = ? per cent.
8. 768 = 4 % of what number?
9. 4500 = $37\frac{1}{2}$% of what number?
10. 2400 = 150% of what number?

34. Problem Test [1]

[Use pencil only when needed.]

1. Find the change from a two-dollar bill in paying the following amounts on packages to be sent by parcel post: 12¢, 20¢, 8¢, 14¢, 32¢.

2. A box weighing 350 lb. is to be sent by express at a charge of 60¢ a hundredweight. The cost is how much more than by sending it by freight at 30¢ a hundredweight?

3. A clerk cuts from a bolt containing 42 yd. of cloth, $8\frac{1}{2}$ yd., $6\frac{3}{4}$ yd., and 12 yd. Find the amount left in the piece.

4. Find the number of lengths $2\frac{1}{2}$ yd. long that can be cut from 15 yd. of goods.

5. Find the amount due on a bill for $3\frac{1}{2}$ yd. of ribbon at 40¢ a yard, and for 10 yd. of lace at $12\frac{1}{2}$¢ a yard.

6. How much more must be paid for an overcoat marked $28 with a discount of 20% than for one selling at $22 with a discount of 10%?

7. A retail merchant sells a bookcase for $27.50. Of this amount 25% is used to pay the running expenses of the store, 60% to pay the cost of the bookcase at wholesale, and 15% is net profit. Find the amount of each item.

8. A fountain pen bought for $1.50 is sold for $2.25. Allowing 20% of the selling price for the running expenses of the store, the profit is how much? The profit is what per cent of the selling price?

9. By following his budget, a boy saved in one month $4.60 out of earnings amounting to $6.00. His savings were approximately what part of his earnings? Find the exact per cent.

10. Express in round numbers correct to the nearest million: In the United States there was raised in a recent year: 3,175,464,000 bushels of corn; 732,740,000 bushels of wheat; and 15,975,000 bales of cotton.

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[1] Pupils should be able to answer, also, questions covering the different types of work studied, such as the following: What is meant by a round number? An approximate answer? What are three of the ways by which the division of 75 by 25 may be expressed? What is a convenient way of finding 25% of a number?

CHAPTER V. HOW WE PROTECT OURSELVES AGAINST LOSS

35. The Meaning of Insurance

To protect persons against loss by fire or other accident, or by death, men form insurance companies. Owing to the fact that losses occur to a comparatively small number of persons, these companies, for a small fee from each patron, are able to pay those who meet losses a comparatively large sum of money. If, for example, a company should insure a house for $5000 against loss by fire, the company might charge the owner some such annual fee as $7.50. From the fact that the company had received many small fees from people whose houses had not burned down, it would be able to pay the owner $5000 if, during the time named in the written contract, his house should burn.

The most common kinds of insurance are: **life, accident, fire,** and **marine.**

Life insurance gives to the relatives or friends of the person insured a certain sum in case of his death.

Accident insurance secures for the person taking out the insurance a certain sum or income in case of accident.

Fire insurance protects the owners of houses, factories, stores, and other buildings, and their contents, from loss by fire.

Marine insurance protects the owners of ships and their cargoes from loss caused by fire or by wreckage.

Besides these principal kinds of insurance, there are many others. Packages sent through the mail may be insured against loss (see page 68); plate-glass windows may be insured against breakage; valuables of all kinds may be insured against theft;

and titles to land may be insured against law suits. It is even possible for a pianist to insure his hands against disuse, or a workman to insure himself from loss by ill health.

In taking out insurance, a written contract is signed. This contract is called a **policy**. The amount of insurance named in the contract is called the **face of the policy**. The fee charged for the insurance is called the **premium**. The length of time covered by the insurance is called the **term of insurance**.

[Without pencil.]

1. Insurance makes it possible for men to undertake business that could not otherwise be undertaken. Why, without it, would men be unwilling to build great factories, conduct large mercantile houses, or send large cargoes across the ocean?

2. In what way is insurance a provision for the sharing of each loss by many people? Why is this a fair arrangement?

3. The face of an insurance policy, — that is, the amount of insurance taken out, — must always be of less value than the property insured. Why is this a wise provision?

36. Fire Insurance

In taking out a fire insurance policy, the charge is made according to the structure of the building, its location, and the use to which it is put. The annual premium, for example, is much lower on a fireproof building used for a dwelling and situated near a hydrant than on a building made of wood, used for the manufacture of furniture, and situated at a distance from water.

The rate of insurance is sometimes given for each $1000 of insurance taken out, and is sometimes expressed in per cents; but the method used most frequently is that of giving the rate for each $100. A rate of $.20 a hundred means that, for each $100 that the person expects to get in case of total loss from fire, he must pay an annual fee or premium of $.20.

[Use pencil only when needed.]

1. A dwelling house valued at $5000 is insured for $\frac{4}{5}$ of its value at $.20 a hundred. What is the yearly fee, or premium?

Since the house is insured for $\frac{4}{5}$ of its value, it is insured for $\frac{4}{5}$ of $5000, or $4000. At the rate of $.20 a hundred, the premium on $4000 is 40 times $.20, or —.

2. A country store and its contents are insured for 80% of their value at the rate of $.22 a hundred. The building is valued at $3000, and its contents at $5000. Find the yearly premium.

Find the yearly premium:

3. On a dwelling valued at $6000, insured for $\frac{9}{10}$ of its value at the rate of $.18 for each hundred dollars.

4. On a new automobile valued at $4000, insured for 80% of its value at $1\frac{1}{2}\%$. On a machine two years old valued at $1500, insured for 40% of its value at 3%.

5. On a factory valued at $80,000, insured for $\frac{4}{5}$ of its value at $2.50 a thousand.

6. Find the difference between the yearly premium on a frame building used as a store and valued at $15,000 and that on a brick building of the same value. Each is insured for $\frac{4}{5}$ of its value, the frame building at the rate of $2.10 a thousand, the brick building at $1.85 a thousand.

7. An automatic standard sprinkler reduces the insurance rate of $4.50 per thousand on a factory, 50 per cent. How much premium is saved per year by this device, if the factory is insured for $200,000?

8. Taking out a policy covering a number of years cheapens the expense for insurance. The rate on a dwelling house in a given locality is $.20 a hundred for a term of 1 year, $.50 a hundred for a term of 3 years, and $.80 a hundred for a term of five years. The rate per year is how much for the policy covering a term of 3 years? For the policy covering a term of 5 years?

9. How much is saved on $5000 in insurance in 15 years by taking out 3 five-year policies instead of 5 three-year policies?

*10. A minimum rate of $2.10 a thousand on a summer hotel is, in the case of a certain hotel, increased $.25 because the building is of wood, and $.15 because of a deficiency in its water supply. The total rate is then decreased 10%, owing to the fact that fire pails filled with water are kept on each floor. Find the yearly premium for a policy covering insurance for $10,000.

*11. Find the expense for insurance on an estate with the amounts and rates as follows: insurance on house, $8000 at $1.90 a thousand; on furniture, $4000 at $2.00; on stable, $3000 at $2.50; on each of two automobiles, $2500 at $1\frac{3}{4}\%$. Increase in rate on house, furniture, and stable, owing to risk of fire from automobiles, $1.00 a thousand.

*12. With the help of the following table of rates, make and solve five problems of your own:

FIRE INSURANCE RATES

(Per $100)

		Combustible Roof	Non-combustible Roof
Dwellings, private, within 500 feet of a public hydrant; with not more than two apartments:			
Brick.	Building	$0.16	$0.14
	Furniture	.20	.18
Frame.	Building	.20	.18
	Furniture	.23	.21
Barns, private, containing no horses used for business purposes:			
Brick.	Building	.21	.19
	Contents	.23	.21
Frame.	Building	.23	.21
	Contents	.25	.23

37. Life Insurance

Men and women who have other persons dependent upon them often have their own lives insured, so that in case of their death, there will be some provision for those who are left. If, for example, a man carried a number of thousand dollars on his own life for the benefit of his family, in case of his death his family would receive the number of thousands named in the insurance policy.

There are many kinds of life insurance policies that may be taken out. The two principal kinds are:

The Ordinary Life Policy. The holder of an ordinary life policy pays a premium at the beginning of each year, from the time he takes out the policy until his death, at which time the face of the policy is paid by the insurance company to the person for whose benefit the insurance was taken out.

The Endowment Policy. This runs for a certain number of years, at the end of which time, if the person insured is still alive, the face of the policy is paid to him, together with interest on it as specified in the policy; but if he dies during the period, his heirs, as in an ordinary life policy, receive the face of the policy, without interest. The premiums are usually paid annually.

BRIEF TABLE OF ANNUAL PREMIUMS FOR INSURANCE OF $1000

Age	Ordinary Life	10-Year Endowment	20-Year Endowment
20	$14.83	$91.29	$41.52
25	16.61	91.53	41.86
30	18.91	91.87	42.35
35	21.90	92.37	43.12
40	25.85	93.13	44.41
50	38.83	96.75	50.53
60	63.08	107.33	67.57

Aside from the three forms of policy named above, a popular one is the **Weekly Insurance Policy.**[1] This policy provides insurance for those who desire to take out policies for sums under a thousand dollars and who wish to pay small sums weekly instead of an annual premium. Ten cents weekly provides an endowment of $94 at the end of twenty years, if taken out on a child ten years old; 25 cents weekly, an endowment of $235.

---

[1] This form is the most expensive kind of life insurance.

[Use pencil only when needed.]

1. Find, in the table on page 78, the yearly premium for an ordinary life policy taken out at the age of 20. At the age of 30. At the age of 60. Why is the annual premium lower for a policy of $1000 taken out at 20 than for one for the same amount taken out later?

2. What is the annual premium for a 10-year endowment policy taken out at the age of 20? Why is this greater than the premium for the ordinary life policy?

3. Find the yearly premium on an ordinary life policy for $3000 taken out at the age of 25. On a 10-year endowment policy taken out at the same time and for the same amount.

4. What is the difference in the annual cost of a 10-year endowment policy for $5000 taken out at the age of 20, and a 20-year endowment policy for the same sum, taken out at the same age?

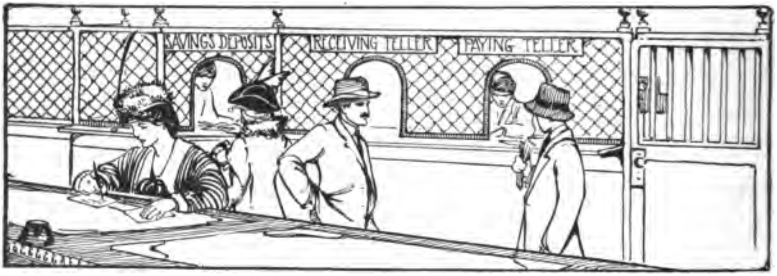
5. What sum of money is paid in annual premiums on a 10-year endowment policy for $1000 taken out at the age of 20 and running its full term? Why is it that the company does not lose on this policy?

6. A man at the age of 20 takes out an ordinary life policy for $4000 and dies at the age of 45. How much more than the sum paid in was received by his heirs?

*7. A weekly insurance policy requiring a premium of 15¢ a week is taken out by a boy 18 years of age. At the end of twenty years, he receives an endowment of $132.00. Find the difference in the amount paid in and the amount received. The same amount deposited in a savings bank would have yielded him at 4 per cent interest, $232.16. Name one advantage of each form of investment.

CHAPTER VI. HOW BANKS HELP US

38. Opening a Bank Account



I

Banks are an important aid in the transaction of business. They lend money, receive deposits for safe keeping, transmit and collect money, cash checks, pay interest on deposits, and otherwise assist men and women in transacting business.

Each bank is usually managed by a board of directors, who have under them, as the chief officers of the bank, the president, the cashier, and the receiving and paying tellers. The president is the person who has a large part of the responsibility for the investments made by the bank and for its general policies; the cashier is the person responsible for the bookkeeping and cash departments; the receiving teller is the man who receives sums of money brought to the bank; the paying teller is the man who pays out sums of money. In small banks the cashier often does the work of both the receiving and the paying teller.

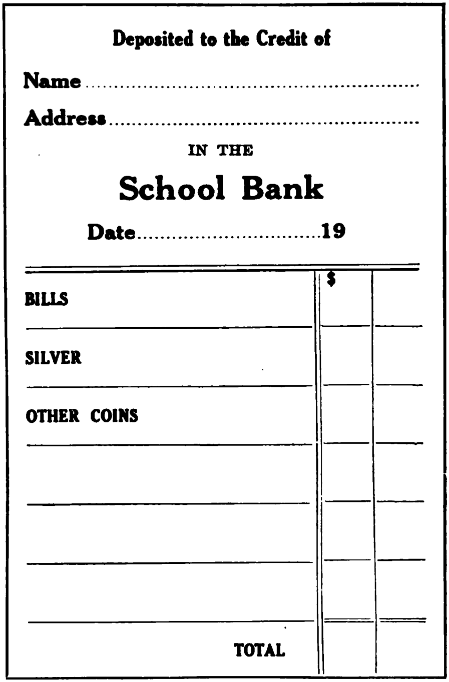
There are two principal forms of accounts that may be opened with a bank. One is called a checking account; the other, a savings account.

Checking accounts are opened largely for the convenience of paying bills by means of checks; savings accounts, to lay up money for the future.

Visit, if possible, a local bank and get samples of deposit slips, checks, and bank books used in keeping a checking account; also, the slips and book used in a savings account.

II. Filling Out a Deposit Slip

In depositing money at a bank for either a checking or a savings account, a printed slip similar to the one given here is filled out by the depositor. On the first blank line is written the name of the depositor; on the second line, his address; on the third line, the date.



Deposited to the Credit of

Name..

Address..

IN THE

School Bank

Date..................................**19**

BILLS	$	
SILVER		
OTHER COINS		
TOTAL		

1. A boy deposits a two-dollar bill, 3 quarters, 2 dimes, and 5 nickels in a bank. In filling out the deposit slip, what sum of money should he write after the word *Bills?* After *Silver?* After *Other coins?* After *Total?*

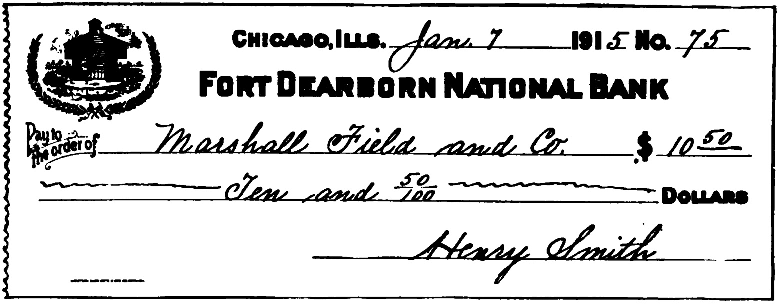
2. Margaret Smith, whose address is 24 Washington Square, deposited Jan. 4, 1915, 2 five-dollar bills, 3 half-dollars, 10 dimes, and 15 cents (in copper). Explain how her slip should have been filled out.

3. George Hart deposits 4 two-dollar bills, 5 half-dollars, 7 quarters, and 14 nickels. Find the total.

*4. Rule and print a deposit slip 3 in. by 6 in., using the one in the picture as a model. Show how you would fill it out if you were to deposit in a bank a five-dollar bill, 5 quarters, and 8 nickels.

III. FILLING OUT AND INDORSING A CHECK

A person who has money in a bank in a checking account usually finds it convenient to pay most of his bills by sending checks through the mail. If, for example, Henry Smith had money in the Fort Dearborn National Bank of Chicago, and owed Marshall Field and Co. $10.50, he would send by mail a check like the one printed below, and Marshall Field and Co., through the bank with whom they do business, would collect the money from the Fort Dearborn National Bank.



CHICAGO, ILLS. Jan. 7 1915 No. 75

FORT DEARBORN NATIONAL BANK

Pay to the order of Marshall Field and Co. $\$\,10^{50}$

Ten and $\frac{50}{100}$ DOLLARS

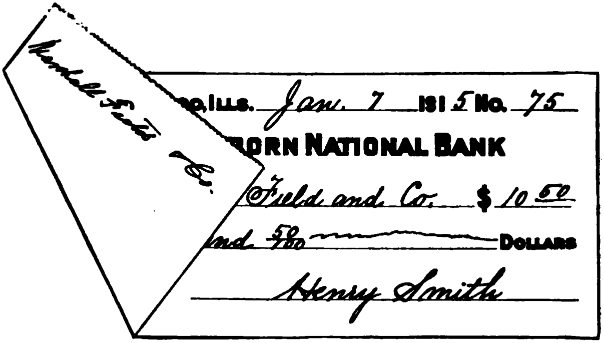
Henry Smith

A Check

1. In filling out a check, first the sum of money to be collected from the bank is written in figures, and then the number of dollars is written in words. What is the reason for repeating the sum of money in this way?

2. Notice, too, that no blank spaces are left on the second line naming the amount of money to be collected. Why is this precaution taken?

Before a check can be cashed, the person or firm to whom it is made out must sign across the back of it. (See check above.) When the name is so written, the check is said to be **indorsed**.



Marshall Field & Co.

o, Ills. Jan. 7 1915 No. 75

orn National Bank

Field and Co. $ 10 50/100

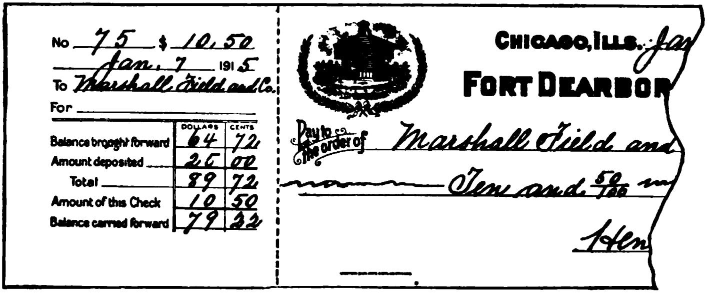
nd 50/100 ——— Dollars

Henry Smith

The Check Indorsed

IV. Check Stubs

In all check books there is a place for a record of deposits made and of all checks drawn. This is often a stub from which the check is torn.



No 75 $ 10.50

Jan. 7 1915

To Marshall Field and Co.

For ____

	Dollars	Cents
Balance brought forward	64	72
Amount deposited	25	00
Total	89	72
Amount of this Check	10	50
Balance carried forward	79	22

Chicago, Ills. Ja

Fort Dearbo

Pay to the order of Marshall Field an

Ten and 50/100

Hen

The Check Stub

In the check stub pictured here, the abbreviation *No.* stands for "Number of check."

[Without pencil.]

1. Why, in using a check book, is it important that the record in the check stubs should be carefully filled in?

2. What is the number of the check pictured on page 83? To whom is the check made payable? What sum is the balance brought forward? What deposit is recorded? What is the amount of the check?

3. In making out the next stub in the check book, what should be the number of the check? The balance brought forward?

[With pencil.]

Copy and fill in the balances, to show how these items would appear in the check stubs:

4. Balance forward, $47.50; deposits, $22.50; check drawn, $14.38; balance forward, ——; deposits, $50.00; check drawn, $12.75; balance forward, ——; deposits, 0; check drawn, $18.42; balance forward, ——; deposits, 0; check drawn, $9.60; balance forward, ——; deposits, $30.00; check drawn, $44.50; balance forward, ——.

5. Balance forward, $133.23; deposits, $110.00; checks drawn, $1.50, $15.00, $10.00; balance forward, ——; deposits, 0; checks drawn, $16.00, $4.20, $2.97; balance forward, ——; deposits, $95.00; checks drawn, $16.00, $6.18, $10.00; balance forward, ——.

6. Balance forward, $62.75; deposits, $75; checks drawn, $24.00, $11.75, $29.78; balance forward, ——; deposits, $10; checks drawn, $2.45, $9.24, $1.75; balance forward, ——; deposits, $50; checks drawn, $8.25, $14.92, $2.14; balance forward, ——; deposits, 0; checks drawn, $1.84, $5.00, $2.35; balance forward, ——.

*7. To understand more clearly how a checking account is conducted, plan a schoolroom bank. Make inquiries as to how an account is opened; obtain, or make, blank deposit slips, checks with stubs, and paper coins and bills; then select a bank cashier and a receiving teller, and choose classmates to open accounts.

39. Money at Interest

I

[Without pencil.]

1. A horse and carriage can be rented from a livery stable for $1.00 an hour. At this rate, how much must be paid for the use of the horse and carriage for 2 hours? For 2½ hours?

2. A man borrows $400, and promises to pay $20 a year for the use of the money. How much must he pay for the loan if he keeps the money 2 years? If he keeps it 2½ years?

3. What sum must be paid for the loan of $1000 for 2 years at the rate of $50 a year?

Money paid for the use of money is called **interest.**

4. What sum of money was the interest in the first part of problem 2? In the second part? In problem 3?

5. In what way does interest resemble the rent for a horse and carriage, or any other form of rent?

II

Interest is reckoned in per cents, the given per cent covering the rate of interest paid each year.

In order to complete the purchase of a home, I borrow $900 from a trust company charging 5% interest. What sum must I return to the bank, if I return the loan at the end of ½ year?

SOLUTION BY ANALYSIS	SOLUTION WITH THE EQUATION
Int. for 1 yr. = 5% of $900, or $45.	Let x = int.
Int. for ½ yr. = $45 × ½, or $22.50	Then, $\$900 \times \frac{5}{100} \times \frac{1}{2} = x$.
Am't due =	$x = 22.50$
$900 + $22.50, or $922.50.	Am't due =
	$900 + $22.50, or $922.50.

In this problem, $900 is the **principal**; $22.50, the **interest**; 5%, the **rate of interest**; ½ years, the **term of interest**; and $922.50, the **amount**.

The **principal** is the sum of money upon which interest is reckoned.

The **rate** of interest is the rate per cent at which the interest is computed.

The **interest** is the percentage found for a given period of time.

The **term** of interest is the time for which the interest is computed.

The **amount** is the sum of the principal and the interest.

[Use pencil only when needed.]

1. Problems in interest are solved just as all problems in percentage are solved, but with one new element to consider, the element of time. Which term in interest corresponds to the base in percentage? Which to the rate? Which to the percentage?

2. Find the interest due on $400 at 3% for 1 year. On $200 at 6% for ½ year. On $2000 at 4% for 3 months (¼ year).

3. What sum must be returned at the end of ½ year, if $400 is borrowed at 5%?

4. Find the amount due at the end of 1 year on $2000 drawing interest at 4%. At the end of 6 months on $3000 drawing interest at 6%.

III

[Use pencil only when needed.]

1. Banks receive money from people who wish to have their money drawing interest, and lend it to those who wish to borrow it. For the money deposited with them, the banks pay a low rate of interest. For the money that they lend, they charge a higher rate of interest. Can you find reasons for this difference?

2. If you were to deposit $100 in a bank paying 3% interest, how much interest would be due you at the end of 1 year? At the end of 6 months?

3. How much interest is due on $500 at the end of 3 months if

deposited in a bank paying 4% interest? How much is due at the end of 6 months?

4. In order to pay his workmen, a contractor borrows, at 6%, the sum of $400. How much interest is due on the loan at the end of 2 months? At the end of 4 months?

Find the interest:

5. For 1 year on $600 at 3%.

6. For ½ year on $800 at 5%.

7. For 6 months on $1200 at 4%.

8. For 4 months on $700 at 6%.

9. For 2 months on $2400 at 5%.

[With pencil.]

10. In a bank paying 4% interest I deposit $350. At the end of a year I withdraw the principal and interest. How much money do I withdraw?

11. What is the amount due on $575 at the end of 6 months, if it has drawn interest at 4%?

12. A bank lends a farmer $650 with which to harvest his crops. The farmer returns the loan with 4 per cent interest at the end of 3 months. What is the amount paid the bank?

Find the amount for the following:

13. Principal, $800; rate, 6%; term, 1 year.

14. Principal, $600; rate, 5%; term, 6 months.

15. Principal, $900; rate, 4½%; term, 3 months.

16. Principal, $4500; rate, 5½%; term, 2 months.

17. Principal, $8750; rate, 5%; term, 6 months.

18. Principal, $37.50; rate, 5%; term, 3 months.

19. Principal, $540.75; rate, 5½%; term, 8 months.

40. Computing Interest with Days

Interest is usually computed by months of 30 days each, with 360 days counted as a year.

I

[With pencil.]

1. A shoe dealer borrows \$400 at 6% for 21 days. What interest must he pay?

The interest equals $\frac{12}{360}$ of the amount due for 1 year. To solve the problem by cancellation, the following form is used:

$$\$400 \times \frac{6}{100} \times \frac{21}{360} = \text{interest.}$$

Notice that, in solving this equation, the work is done in the easiest way if the 100 below the 6 is cancelled by pointing off two decimal places in some numerator; in this case, \$400.

Using the form given above, find the interest due:

2. On \$800 at 5% for 30 days.
3. On \$1800 at 6% for 60 days.
4. On \$400 at 4% for 90 days.
5. On \$9000 at 6% for 18 days.
6. On \$2500 at 5% for 12 days.
7. On \$4000 at 4% for 24 days.

8. A man borrows \$2000 from a bank at 5% for 60 days. What amount does he owe the bank at the end of the time?

$$\$2000 + \left(\$2000 \times \frac{5}{100} \times \frac{60}{360}\right) = \text{amount.}$$

Find the amount due:

9. On \$8000 at 6% for 6 days.
10. On \$9000 at 5% for 14 days.
11. On \$12,000 at 3% for 9 days.
12. On \$840 at 6% for 21 days.
13. On \$180 at 7% for 12 days.
14. On \$7200 at 5½% for 17 days.

II

In computing the term of interest between two dates, it is usually customary (1) to count 30 days to the month as shown in the method given below, or (2) to count the exact number of days as shown in the method given on page 90.

What interest at 5% is due on \$500 from September 1, 1918, to November 15, 1918?

Solution A:

From Sept. 1 to Nov. 1, the time is 2 mo.
From Nov. 1 to Nov. 15, the time is 14 da.

The interest on \$500 at 5%:

For 1 yr. = \$25.00.
For 2 mo. = $\frac{1}{6}$ of \$25.00, or \$4.17.
For 14 da. = $\frac{14}{360}$ of \$25.00, or \$.97.
The total int. = \$4.17 + \$.97, or \$5.14.

Solution B:

Since 2mo. 14 da. = 74 da., this problem may be solved by cancellation by the use of the following equation:

The interest = \$500 × $\frac{5}{100}$ × $\frac{74}{360}$, or \$5.14.

Find the interest due: [With pencil.]

1. On \$600 at 5% for 6 mo. 12 da.
2. On \$1200 at 6% for 4 mo. 15 da.
3. On \$420 at 4% for 2 mo. 10 da.
4. On \$1000 at 4½% for 1 mo. 9 da.

Find the interest due, computing the term of interest by the method given above:

5. On \$200 at 4%, from Jan. 15, 1918, to Mar. 15, 1918.
6. On \$1000 at 3%, from June 10, 1920, to Sept. 28, 1920.
7. On \$800 at 5%, from Aug. 13, 1915, to Nov. 22, 1915.
8. On \$4000 at 6%, from Mar. 4, 1917, to Mar. 31, 1917.
9. On \$3500 at 5%, from Sept. 18, 1919, to Feb. 27, 1920.

III

[With pencil.]

In the following problems use the exact number of days:[1]

1. What is the interest on $2000 at 4% from Sept. 3, 1921, to Oct. 14, 1921?

The exact number of days from Sept. 3, 1921, to Oct. 14, 1921, is 27 days + 14 days, or 41 days. The interest = 4% of $2000 for a term of $\frac{41}{360}$ years.

Find the interest:

2. On $1000 at 3% from Sept. 1 to Sept. 21, in the same month.
3. On $2000 at 4% from May 15 to May 31, in the same month.
4. On $1500 at 5% from July 5 to August 19, in the same year.
5. On $2500 at 4% from Oct. 1 to Dec. 10, in the same year.
6. On $5000 at 5% from Jan. 14 to Mar. 15, in the same year.
7. On $10,000 at 6%, from Apr. 18, 1921, to July 2, 1921.
8. On $15,000 at 3½%, from Oct. 19, 1920, to Jan. 12, 1921.

*9. Find the difference in the interest on $15,000 at 5%, from Apr. 19, 1918, to Aug. 1, 1918, computed by the method given above and by the one given on page 89.

41. An Account with a Savings Bank

At the time of opening a savings account with a bank, each person receives a bank book in which are written the amounts deposited and those withdrawn. In depositing money, a slip similar to the one pictured on page 81 is used. At the time of withdrawal, a withdrawal blank is filled out and handed, with the bank book, to the bank teller.

In reckoning the interest on money deposited in a savings bank, at the end of stated periods — usually every six months — the interest that has accumulated is put with the principal and from then on draws interest. If, for example, $100 were deposited in a savings bank paying 2% semi-annual interest, at the end of 6 months the interest ($2) would be put with the $100, and the principal drawing interest for the next six months would be $102. At the end of the next period the interest (2% of $102, or $2.04) would be added to the $102 (omitting the cents), and the new principal to draw interest would be $102 + $2, or $104. Such a form of interest is called compound interest.

---

[1] In computing interest on large sums of money, not only is the exact number of days in the term of interest used but sometimes 365 days are counted as a year. This method is used only under special conditions. In the problems above, 360 days should be counted as a year

In computing compound interest, tables are frequently used.

COMPOUND INTEREST TABLE

Showing the amount of one dollar at the given rates for any number of periods up to ten

Number of Periods	1%	1½%	2%	2½%	3%	3½%	4%
1	1.010000	1.015000	1.020000	1.025000	1.030000	1.035000	1.040000
2	1.020100	1.030225	1.040400	1.050625	1.060900	1.071225	1.081600
3	1.030301	1.045678	1.061208	1.076891	1.092727	1.108718	1.124864
4	1.040604	1.061364	1.082432	1.103813	1.125509	1.147523	1.169859
5	1.051010	1.077284	1.104081	1.131408	1.159274	1.187686	1.216653
6	1.061520	1.093443	1.126162	1.159693	1.194052	1.229255	1.265319
7	1.072135	1.109845	1.148686	1.188686	1.229874	1.272279	1.315932
8	1.082857	1.126493	1.171659	1.218403	1.266770	1.316809	1.368569
9	1.093685	1.143390	1.195093	1.248863	1.304773	1.362897	1.423312
10	1.104622	1.160541	1.218994	1.280085	1.343916	1.410599	1.480244

[With pencil.]

1. If I leave $200 in a savings bank to draw 3% annual interest compounded semi-annually, what sum can I withdraw at the end of 4 years?

Since the interest on the deposit is compounded semi-annually for 4 years, the interest periods are 8. Annual interest of 3% is equal to semi-annual interest of 1½%. From the table it can be seen that the amount for $1.00 at 1½% for 8 periods is $1.126493. The amount for $200 is 200 times $1.126493, or —.

---

[1] For a more complete treatment of this topic, see page 170, Part Six.

Using the table, find the amount that can be withdrawn:

2. At the end of 10 years, if $500 is left to draw interest at 4% compounded annually.

3. At the end of 3 years, if $400 is left to draw interest at 4% compounded semi-annually.

4. At the end of 5 years, if $800 is left to draw interest at 3% compounded semi-annually.

5. At the end of 2 years, if $1000 is left to draw interest at 4% compounded quarterly.

6. Suppose you deposited $50 in a savings bank and left it to draw interest for 5 years at 4% annual interest compounded semi-annually. How much money could you withdraw at the end of the period?

*7. Find the amount that could be drawn from a savings bank at the end of five years, if $100 were deposited at the beginning of each year. Rate of interest, 4% compounded semi-annually.

*8. Two brothers have each saved $500. One brother puts his savings into a bank paying 3% simple interest; the other puts his into a bank paying 3% interest compounded semi-annually. Find the difference in the amounts the two brothers can draw from their banks at the end of 3 years.

*9. Without using the table, find the compound interest due at the end of 4 years on $100 at 5%, compounded annually.

42. Indirect Problems in Interest

Problems requiring the interest or the amount are the ones most frequently met. All other problems, such as finding the principal, the rate, or the term of interest, are sometimes spoken of as indirect problems. These problems can be solved either by using the interest for one year as the basis or by using the equation with which you have become familiar. (See page 85.)

I. Finding the Rate of Interest

The interest on \$400 for 2 years is \$20. What is the rate?

(A)

Int. for 2 yr. = \$20.
Int. for 1 yr. = \$10.

\$10, the int. for 1 yr., compared with \$400, the prin., = $\frac{10}{400}$.

$\frac{10}{400}$, or $\frac{1}{40}$, = $2\frac{1}{2}\%$.

(B)

Let x = per cent of int.

Then $400 \times \frac{x}{100} \times 2 = 20$.

Canceling and combining terms,

$$8x = 20.$$
$$x = 2\frac{1}{2}.$$

[With pencil.]

1. The interest on \$500 for 3 years is \$75. What is the rate of interest?

2. At what rate must \$900 be put at interest to yield \$108 simple interest in 2 years?

Find the rate of interest:

3. Principal, \$1200; interest for 1 year, \$60.

4. Principal, \$600; interest for 6 months, \$30.

5. Principal, \$800; interest for 3 months, \$10.

6. Principal, \$750; interest for $\frac{1}{2}$ year, \$15.

7. Principal, \$475; interest for $1\frac{1}{3}$ years, \$9.50.

*8. At what rate will \$500 yield an amount of \$550 in 2 years?

*9. Find the rate which will yield an amount of \$5006.25 from a principal of \$4500 in $2\frac{1}{2}$ years.

II. Finding the Principal

[With pencil.]

1. What sum of money put at interest at 5% yields an income of \$900 in $1\frac{1}{2}$ years?

Since the interest for $1\frac{1}{2}$ yr. = \$900, the interest for 1 year = $\frac{2}{3}$ of \$900, or \$600. 5% of prin. = \$600. 100% of prin. = —.

In solving this problem with x standing for the principal, the equation used is $x \times \frac{5}{100} \times \frac{3}{2} = \$900$.

2. Find what sum of money at 4% will yield \$1000 in 1 year?

3. A bank receives \$300 interest for ½ year on money loaned at 6%. What was the amount of the loan?

4. Find the principal that yields \$50 in 1 year at 5%. That yields \$75 in 6 months at 2½%. That yields \$120 in 4 months at 4%.

5. What principal drawing 5% interest amounts to \$4400 in 2 years' time?

Since, in 2 years, \$1.00 drawing 5% interest = \$1.10, the principal required to yield \$4400 = \$4400 ÷ \$1.10.

In solving this problem with x standing for the principal,

$\frac{5x}{100}$ = int. for 1 yr. $\frac{10x}{100}$ = int. for 2 yr.

$x + \frac{10x}{100}$ = am't for 2 yr.; that is, $\frac{110x}{100}$ = \$4400.

6. A family wishes to purchase a house for \$8800. In order to pay for the house, what sum of money must be put at 5% interest to yield the amount required in 2 years, if the interest is not compounded?

7. To have \$2360 at the end of 3 years, what principal must be invested at 6% simple interest?

*8. The amount from a given principal invested for 6 months at 4½% is \$1227. Find the principal.

III. Finding the Term of Interest

[Use pencil only when needed.]

1. What length of time is required for \$500 drawing 2½% interest to yield an income of \$100?

Int. for 1 year = 2½% of \$500, or \$12.50. No. of years required to yield an interest of \$100 = \$100 ÷ \$12.50.

Solution with x: Let x = no. of years. Then $\$500 \times \frac{2\frac{1}{2}}{100} \times x = \$100$.

2. The interest from \$800 at 4% is \$64. Find the time.

3. Find the time required for \$2000 at 6% to draw interest amounting to \$600.

Find the term of interest:

4. Principal, \$500; rate, 5%; interest, \$50.

5. Principal, \$4000; rate, 6%; interest, \$720.

6. Principal, \$700; rate, 3%; interest, \$10.50.

*7. A sum of \$5000 at 4% yields an amount of \$5500. Find the time required.

*8. Find the time required for \$2500 to amount to \$2850, at $3\frac{1}{2}$% simple interest.

43. Test and Supplementary Practice

Test your accuracy in solving problems in interest by solving the problems in Exercise I. If, in this work, you fall below the standard for your class, review the lessons on Interest and solve the problems in Exercise II.

I

[Without pencil.]

1. A man borrows \$500 at 4%. How much interest must he pay each year?

2. Find the interest on \$4000 at 6% for a term of 6 months.

3. To pay his workmen, a builder borrows \$400 from a bank at 5%. He pays his indebtedness to the bank at the end of 6 months. Find the amount due.

4. I lend \$1000 for which I receive \$50 interest annually. Find the rate of interest.

5. From another man, I received \$300 interest annually. What is the amount of the loan if the rate is 6%?

6. On July 15, a man borrows a sum of money to be returned in 30 days. On what date should he return the money?

7. A sum of money is borrowed September 18 and returned

November 21 of the same year. Find the exact number of days in the term of interest.

[With pencil.]

8. Find the interest at 5% on $4500 for 6 months.

9. $2500 is borrowed July 15 and returned September 13 of the same year. What was the amount returned, if the interest paid was 6%?

10. Find the amount due at 4½% on $800 returned after 3 months and 10 days.

11. $4000 yields an annual interest of $220. What is the rate of interest?

12. Find the sum of money that must be invested at 5% to yield an annual income of $1200.

II

Complete:

[With pencil.]

	PRINCIPAL	RATE	TIME	INTEREST	AMOUNT
1.	$475	4%	3 mo.	?	?
2.	$2000	5½%	1 yr.	?	?
3.	$1500	5%	90 da.	?	?
4.	$350	?	½ yr.	$10.50	
5.	$575	?	1 yr.	$40.25	
6.	$4500	6%	?	$90	
7.	$3800	4½%	?	$85.50	
8.	?	5%	1 yr.	$300	
9.	?	4%	6 mo.	$2700	
10.	$5000	?	1 yr.	?	$5250

CHAPTER VII. THE USE OF GEOMETRIC FORMS IN MEASUREMENTS

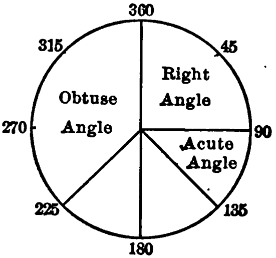
44. Lines and Angles

I

The amount of divergence between two straight lines is called an **angle.**

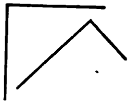
In the church tower pictured here, the lines framing the front face of the part containing the clock dial form what are called "square corners," or **right angles**; the lines framing in the faces of the spire and meeting at the peak form **acute angles**; the lines meeting below the clock dial form an **obtuse angle.**

Angles are measured by the degrees in a circle.

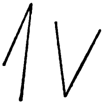


360 degrees (°) = a circle

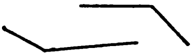
1. How many degrees are there in one fourth of a circle?



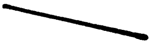
Right Angles



Acute Angles



Obtuse Angles



A Straight Angle

A **right angle** is an angle containing 90 degrees.

An **acute angle** is an angle containing less than 90 degrees.

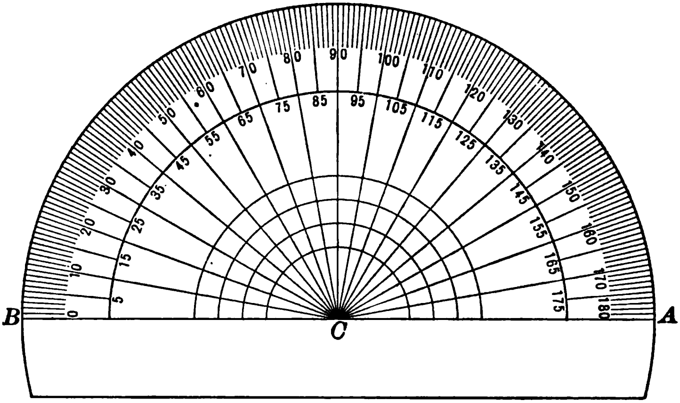
An **obtuse angle** is an angle containing more than 90 degrees.

A **straight angle** is an angle containing 180 degrees.

2. What kind of angle is formed by the hands of a clock at 3 o'clock? At 6 o'clock? At 2 o'clock? At 5 o'clock?

3. Open a book in a way to show what is meant by a right angle. By an acute angle. By an obtuse angle.

A half-circle marked off in degrees and used to measure angles is called a **protractor**.

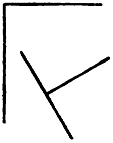


A Protractor

4. Draw paper triangles of different shapes. Estimate with the eye the number of degrees in each angle formed within the triangle, then write the estimate.

5. Cut out the triangles and measure each angle on the protractor. To do this, first place at *C*, in the protractor, the point of divergence of the two lines forming the angle, then see that one side of the angle is on the line *BC*. Compare the number of degrees in each angle with your estimate.

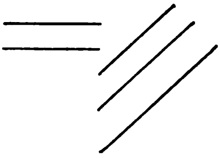
II



Perpendicular Lines

Lines meeting at right angles are said to be **perpendicular** to each other.

Lines drawn in the same direction so that, no matter how far they were extended, they would never meet are called **parallel lines.**



Parallel Lines

A line parallel to the surface of still water is called a **horizontal line**.

A line perpendicular to a horizontal line and following the direction of a plumb-line is called a **vertical line**.

All straight lines that are neither horizontal nor vertical are **oblique lines**.

1. Find, in the picture of the church tower, on page 97, examples of the different kinds of lines defined above.

2. Draw on a blackboard a line perpendicular to a horizontal line. To a vertical line. To an oblique line.

3. Draw two horizontal lines parallel to each other.

4. Draw three vertical lines parallel to one another.

5. Draw three oblique lines parallel to one another.

6. Point out in objects about you different kinds of lines.

*7. Draw a pattern for an envelope, then point out in the pattern different kinds of angles and lines.

45. Review of Linear, Square, and Cubic Measures

I

[Use pencil only when needed.]

1. A tennis court is 78 ft. long. What is its length in yards?

2. A playground is 10 rods in width. What is its width in feet?

3. A running track extends $\frac{1}{8}$ of a mile. What is the distance around the course in feet? In yards?

4. Write the table of linear measure.

5. With the help of the table of linear measure, build as far as possible the tables of square and cubic measure.

6. Complete the tables and then compare them with those at the back of the book.

7. What unit of measure is commonly used in finding the area of a room? Of a sidewalk? Of a field?

8. In excavating a cellar, by what unit of measure is the quantity of earth computed?

Reduce:

9. 8 ft. 9 in. to inches.
10. 15 yd. 2 ft. to feet.
11. 1 rd. 2 ft. to feet.
12. 1 mi. 40 rd. to rods.
13. 50 rd. to yards.
14. 5 rd. to feet.
15. .25 mi. to feet.
16. 640 rd. to miles.
17. 500 ft. to rods.
18. 1 sq. ft. 8 sq. in. to square inches.
19. 4 sq. rd. 5 sq. ft. to square feet.
20. 1 A. 40 sq. rd. to square rods.
21. 480 sq. rd. to acres.
22. 2.25 sq. yd. to square feet.
23. 1.75 sq. rd. to square feet.
24. .125 A. to square rods.
25. 1 cu. yd. 10 cu. ft. to cubic feet.
26. 1000 cu. ft. to cubic yards.

27. The standard bushel contains 2150.42 cu. in. This is approximately how many cubic feet?

II

[Use pencil only when needed.]

1. What is the combined length of two boards, one 4 ft. 8 in. long, the other 3 ft. 11 in. long?

2. Find the sum of 14 yd. 18 in., 3 yd. 16 in., 10 yd. 24 in. Of 1 rd. 13 ft. and 3 rd. 8 ft. Of $\frac{1}{4}$ A. and 150 sq. rd.

3. A living room is 16 ft. 6 in. wide and 18 ft. 9 in. long. Its length is how much greater than its width?

4. Find the difference between 13 yd. 21 in. and 2 yd. 27 in. Between $1\frac{1}{2}$ rd. and 40 ft. Between $\frac{1}{2}$ mi. and 2000 ft. Between 1 A. and 120 sq. rd.

5. A triangular field measures 14 rd. 8 ft. on a side. What is the distance around it?

6. Multiply: 3 yd. 8 in. by 9; 2 sq. yd. 3 sq. ft. by 10; $1\frac{3}{4}$ cu. ft. by 12.

7. A garden measures 9 yd. 2 ft. across. What is $\frac{1}{2}$ its width?

8. Divide: 64 yd. 27 in. by 3; 1 mi. 80 rd. by 4; 1 sq. ft. 18 sq. in. by 2.

9. Divide: 10 ft. by 8 in.; 12 yd. by 6 in.; 1 sq. ft. by 3 sq. in.; 1 cu. ft. by 9 cu. in.

10. Express as a decimal part of a yard, 27 inches. As a decimal part of an acre, 40 sq. rd. As a decimal part of a cubic yard, 9 cu. ft.

Solve, using decimals wherever convenient:

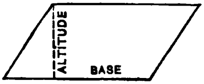
11. 14 yd. 18 in. + 3 yd. 27 in. = ?
12. $12\frac{7}{8}$ yd. − 4 yd. 9 in. = ?
13. 1 mi. 80 rd. − 160 rd. = ?
14. $1\frac{1}{4}$ A. − 80 sq. rd. = ?
15. $10\frac{1}{2}$ cu. ft. × $4\frac{1}{4}$ = ?
16. 3 yd. 9 in. × $14\frac{1}{2}$ = ?
17. $1\frac{3}{4}$ cu. in. × $3\frac{2}{5}$ = ?
18. 24 yd. 27 in. ÷ 3 = ?
19. 1 mi. 40 rd. ÷ 4 = ?
20. $12\frac{3}{4}$ rd. ÷ 2 ft. = ?

*21. Two and one half acres of land are divided into 20 building lots of equal area. Find how many square feet each contains.

46. Quadrilaterals

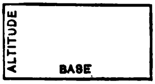
I. Kinds of Quadrilaterals

A plane surface bounded by four straight lines is called a **quadrilateral.**



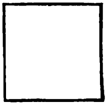
Parallelogram

A quadrilateral with its opposite sides parallel is called a **parallelogram.**



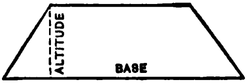
Rectangle

A quadrilateral with its opposite sides parallel and its angles right angles is called a **rectangle.**



Square

A rectangle with four equal sides is called a **square.**



Trapezoid

A quadrilateral with only two sides parallel is called a **trapezoid.**

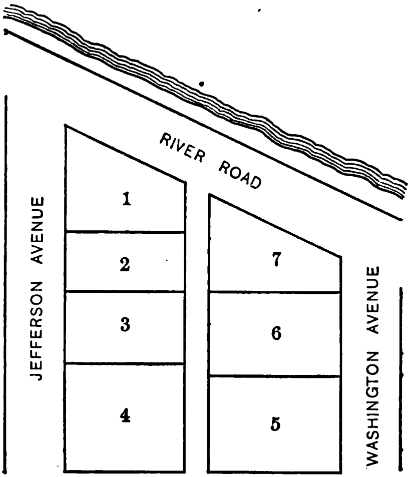
The **altitude** of a quadrilateral is the perpendicular distance from a line regarded as the base to a point even with the highest point in the quadrilateral. (See dotted lines in the drawings above.)

1. Classify, according to shape of surface: a baseball "diamond"; the United States flag; diamond panes in a window; the faces of a cube.

2. Make drawings of parallelograms, rectangles, and trapezoids of different proportions and in different positions. Draw in each a dotted line to indicate its altitude.

II. The Area of a Rectangle

[Use pencil only when needed.]



1. The plan given here is a map of building lots for sale in a city addition. Lots 2, 3, 4, 5, and 6 are rectangles. Explain how the area of each can be found.

2. Lot 2 has a frontage of 50 ft. and a depth of 100 ft. What is its area?

3. Lot 3 has a frontage of 60 ft.; lot 4, a frontage of 90 ft. Both have a depth of 100 ft. Find the difference in price of the lots at 15¢ a square foot.

4. Lot 5, which contains 8800 sq. ft., has a depth of 110 ft. What is the width of the lot?

The number of feet in the width of the lot can be found by dividing the area, 8800 sq. ft., by the number of square units contained in one row along the depth of 110 ft. 8800 sq. ft. ÷ 110 sq. ft. = —. The width of the building lot is —.

5. Find the width of a rectangular building lot containing 4800 sq. ft. Depth of lot, 80 ft.

6. Lot 6, which has a depth of 110 ft. and contains 7700 sq. ft., is for sale at 10¢ a square foot. This is how much a front foot?

7. Find the price by the front foot of a lot containing 6600 sq. ft. Depth of lot, 120 ft. Price, 15¢ a square foot.

8. A garden containing 3000 sq. ft. is 60 ft. wide. What is its perimeter?

9. An acre of land 10 rods wide is how many rods in length? At

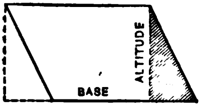
10¢ a foot, how much does it cost to enclose the acre with wire fencing?

10. A school playground containing 1¼ acres is 15 rods in width. What is its length in feet? Its perimeter in yards?

11. A field 330 ft. in width and 400 ft. in length is worth how much at $90 an acre?

*12. A real estate agent divides 1½ acres of land into 12 building lots and sells them at 10¢ a square foot. The average frontage of each lot is 50 ft. Find the price of each by the front foot.

III. The Area of a Parallelogram



1. Draw on paper a parallelogram with a base of 3 inches and an altitude of 2 inches. Cut off the triangle corresponding to the shaded portion in the illustration and fit it to the opposite end in the place marked by the dotted lines. What kind of figure is the parallelogram after the change?

2. Compare the base of the parallelogram with the base of the new figure. Compare their altitudes.

3. Show that the following rule is true:

To find the area of a parallelogram, multiply the base by the altitude.

[Use pencil only when needed.]

4. A parallelogram has a base of 12 in. and an altitude of 8½ in. What is its area?

Find the area in square feet of the following parallelograms:

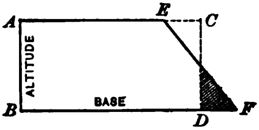
5. Base, 10 ft.; altitude, 3 ft., 3 in.

6. Base, 300 ft.; altitude, 10 yd.

*7. A certain field is a parallelogram with a base of 30 rods and an altitude of 396 ft. Find its value at $75 an acre.

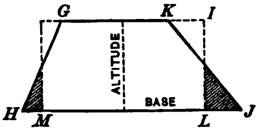
IV. THE AREA OF A TRAPEZOID

[Use pencil only when needed.]



1. If, from the trapezoid pictured here, the shaded portion were cut off and then fitted into the space marked by the dotted lines, what figure would be formed?

2. What would be the length of the base of the new figure, if the distance from *A* to *E* is 8 in. and the distance from *B* to *F* is 12 in.? Why?



3. What figure would be formed if the shaded portions in this trapezoid were fitted into the spaces marked by the dotted lines?

4. Call the length of *GK* 6 in. and *HJ* 12 in. What then is the base of the equivalent figure? How is it found?

5. If the altitude of the trapezoid *GKJH* is 5 in.; the distance from *G* to *K*, 6 in.; and from *H* to *J*, 12 in., what is the area of the trapezoid?

To find the area of a trapezoid, multiply one half the sum of the parallel sides by the altitude.

6. The parallel sides of a trapezoid are respectively 22 in. and 26 in. long. Its altitude is 10 in. What is its area in square inches? In square feet?

7. A piece of leather is a trapezoid with its parallel sides 18 in. and 24 in. long and an altitude of 16 in. At 15¢ a square foot, what is the price of the piece?

8. Building lot No. 1, pictured on the map, page 103, is a trapezoid with its parallel sides 90 ft. and 40 ft. long. The altitude of the trapezoid is 100 ft. What then is the area of the building lot?

9. Lot 7, pictured on the same map, is a trapezoid with its parallel sides 80 ft. and 30 ft. long. The altitude of the trapezoid is

110 ft. Estimate, then find, the difference in the area of these two lots. (See problem 8.)

10. Find how many acres there are in a field that is a trapezoid with parallel sides 30 rd. and 50 rd. long. Altitude of the trapezoid, 20 rd.

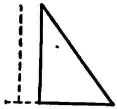
*11. A field is in the shape of a trapezoid with parallel sides 350 ft. and 310 ft. long, with an altitude of 10 rd. What is the value of the field at $110 an acre?

47. Triangles

I

1. With the help of the definition of a quadrilateral on page 102, define a triangle.

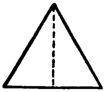
2. Thinking of the form of the word *triangle* (*tri* means three), how else might a triangle be defined?



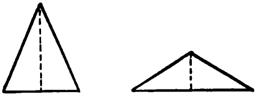
Right-Angled Triangle

A triangle with one of its angles a right angle is called a **right-angled triangle**, or **a right triangle.**

A triangle with its three sides equal in length is called an **equilateral triangle.**



Equilateral Triangle



Isosceles Triangles

A triangle with only two of its sides equal is called an **isosceles triangle.**

The altitude of a triangle is measured by a line drawn at right angles to one of the sides taken as the base. (See dotted lines in drawings.)

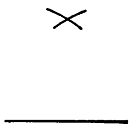
The point of the angle opposite the line taken as the base is called the **apex** of the triangle.

3. Draw an equilateral triangle, an isosceles triangle, and a right-angled triangle, indicating with a dotted line the altitude of each.

4. Draw three triangles, no one of which is right-angled, equilateral, or isosceles. Indicate the altitude of these triangles.

II

To draw an equilateral triangle with a compass, place the pin end of the compass at one end of the line drawn for the base of the triangle; spread the points of the compass so that the distance between them equals the length of the line drawn for the base, and draw an arc as indicated in the diagram. Next, change the pin end of the compass to the opposite end of the base line and draw another arc. The point of the intersection of the two arcs is the apex of the triangle. Connect this point with the two ends of the base line, and the result is an equilateral triangle.



Drawing an Equilateral Triangle

1. Draw an equilateral triangle measuring 2 inches on a side. Draw one measuring $1\frac{1}{2}$ inches on a side.

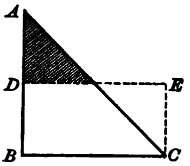
2. Draw a triangle with sides measuring 3, 4, and 5 inches respectively. What kind of triangle is the result?

3. Draw a triangle with sides measuring 6, 8, and 10 inches. Try other multiples of 3, 4, and 5. What kind of triangle is the result in each case?

*4. With the shortest side of each not less than 2 inches in length, draw an equilateral triangle, an isosceles triangle, and a right-angled triangle. Cut them out, and then, with the help of the protractor on page 98, make careful measurements of the degrees in each of the angles. Find the sum of the angles in each triangle.

III. THE AREA OF A TRIANGLE

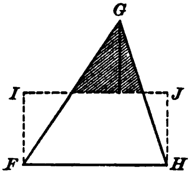
[Use pencil only when needed.]



1. Show by paper cutting that the triangle *ABC* is equal in area to the rectangle *BDEC*.

2. What is the relation of the altitude of the rectangle formed to the altitude of the triangle?

3. Show by paper cutting that the triangle *FGH* is equal in area to the rectangle *FIJH*.



4. Compare the base of the triangle with that of the rectangle. Compare their altitudes.

5. What rectangle is equivalent to a triangle with a base of 6 in. and altitude 10 in.? What is the area of the rectangle? Of the triangle?

6. Show that this rule is true:

To find the area of a triangle, find one half the product of the base and the altitude.

7. What is the area of a triangle with a base 8 in. long and an altitude of 12 in.? With a base 4½ in. long and an altitude of 6 in.? With a base of 12 ft. and an altitude of 2 yd.?

8. A sail, equivalent to a triangle with a base of 9 ft. and an altitude of 12 ft., exposes how many square feet of surface to the wind when unfurled?

9. A pennant, equivalent to a triangle with a base of 1 yd. and an altitude of 7 ft., contains how many square yards of material?

10. A triangular field with a base of 40 rd. and an altitude of 20 rd. contains how many acres?

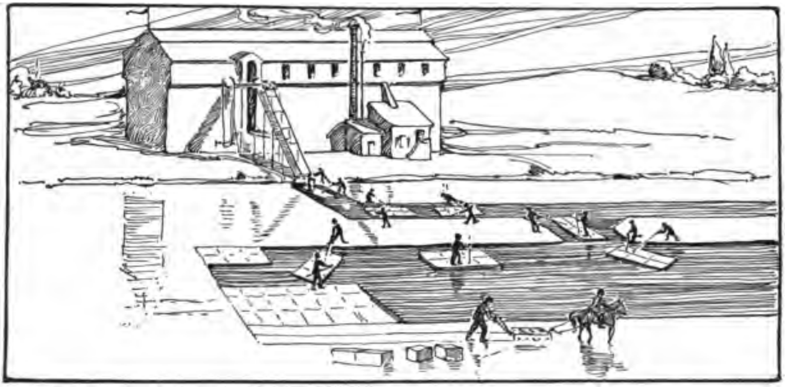
*11. Find the number of acres in a triangular lot with a base of 40 rd. and an altitude of 330 ft.

*12. A certain field is a parallelogram with a base of 40 rd. and an altitude of 20 rd. This field contains how many more acres than a triangular field with the same base and altitude?

*13. The gable of a house has a base of 10 ft. 9 in. and an altitude of 6 ft. 7 in. How many square feet does it contain?

*14. Cut out triangles of different shapes and figure out their areas.

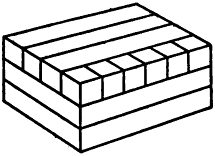
48. Rectangular Prisms



Cakes of ice, blocks of stone, and heavy timbers are usually cut so that they have rectangular surfaces. All such solids are called **rectangular prisms**.

In measuring the contents or volume of a prism, such cubic units as the cubic inch, the cubic foot, and the cubic yard are used. Name a use for each of these measures.

In finding the number of cubic units in a prism, the length may be taken to indicate the number of cubic units that are contained in one row of one layer of the prism. The breadth then indicates the number of rows of cubic units in each layer, and the thickness indicates the number of layers of cubic units contained in the prism. For example, a rectangular prism 6 in. by 4 in. by 3 in. contains 6 cu. in. multiplied by 4 and then by 3.



To express briefly directions for finding the number of cubic units in a solid, this rule is given:

To find the cubical contents, or volume, of a prism, multiply the length by the breadth by the thickness.

[Use pencil only when needed.]

1. How many cubic inches are there in a rectangular prism 8 in. long, 4 in. wide, and 2 in. high? In a prism 3″ by 4″ by 10″? In a prism 2″ × 4″ × 12″?

2. Find the number of cubic feet in a rectangular box 4 ft. × 3 ft. × $2\frac{1}{2}$ ft.

3. A cellar 27 ft. wide and 40 ft. long is to be excavated to a depth of 6 ft. Find the cost at $1.00 a cubic yard.

4. At the same rate, find the cost of digging for a foundation wall a trench $1\frac{1}{2}$ ft. wide, 1 ft. deep, and 120 ft. long.

To estimate the number of bushels of ear corn in a bin or other receptacle, 2 bushels are counted to each 5 cubic feet. Find the approximate number of bushels of ear corn:

5. In a corn crib 10 ft. wide, 32 ft. long, filled to an average depth of 6 ft.

6. In two sections of a crib, each 10 ft. by 16 ft. One section is filled to a depth of 10 ft.; the other, to a depth of 8 ft.

7. In a wagon box 3 ft. wide, 10 ft. long, filled to a depth of 2 ft.

In measuring wheat and other grains, 4 bushels are counted to each 5 cubic feet. Find the approximate number of bushels of grain:

8. In a bin 10 ft. wide, 12 ft. long, filled to an even depth of 8 ft.

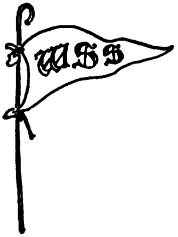
9. In a wagon box, 3 ft. wide, 10 ft. long, filled to an even depth of 2 ft. 3 in.

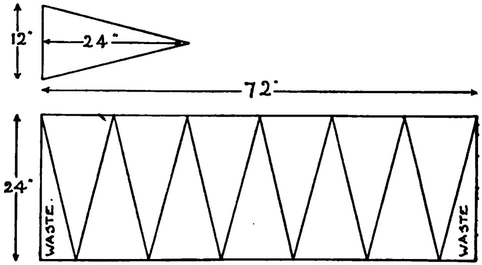
10. In a freight car measuring on the inside 8 ft. 6 in. in width and 30 ft. in length, filled to an even depth of 4 ft.

*11. A standard bushel is equivalent to 2150.42 cu. in. Find the exact number of bushels in the bin described in problem 8. In the freight car described in problem 10.

*12. A rectangular tank 4 ft. wide and 6 ft. 3 in. long must be filled to what depth to contain 100 cu. ft. of water?

49. Cutting Material Economically





[Use pencil only when needed.

1. Felt comes 72 inches wide. What is the smallest amount to purchase for 22 school flags of the dimensions shown in the pattern pictured here?

2. Show by a drawing how many of the flags can be cut from ½ yard of the felt.

3. When felt is $1.80 a yard, the cost of each flag cut from the half-yard of goods is how much greater than each one cut from a piece of felt 24 inches long?

4. The stock size from which printers cut business cards is 22″ × 28″. Show by a drawing how many rectangular cards 2″ × 3″ can be cut from one sheet of the cardboard.

5. Find the largest number of cards that can be cut from one sheet, if each card is 2½″ × 4″. If each is 4″ × 5½″. If each is 2¾″ × 4″.

*6. Find the dimensions of the smallest possible rectangle of cardboard from which to cut the four vertical sides of a waste-basket, if each side is a trapezoid with an altitude of 14 in. and the parallel sides are respectively 7 in. and 9 in. long. (Make a drawing.)

*7. Prove, by a drawing, that 40 cards 3″ × 5″ can be cut from a sheet of cardboard 22″ × 28″.

50. Planning Home Improvements

The attractiveness of a home has little to do with its size or its expensiveness. It largely depends upon the neatness and care with which the house and grounds are kept. The cheapest forms of improvements about a house are those that come from fresh paint and paper; the more expensive ones are those that come from laying hardwood floors and putting in the most convenient forms of heating and lighting. The grounds about a place are improved by setting out plants, shrubs, and trees, and by building good fences and laying good walks.

[Use pencil only when needed.]

1. A quart of paint will cover about 9 sq. yd. of a floor in painting the first coat and about 12 sq. yd. in painting the second coat. At 90¢ a quart, what is the approximate cost for 2 coats of paint for a kitchen floor 12 ft. by 9 ft.?

2. At the same rate, what is the approximate cost for two coats of paint on a porch floor 10 ft. by 18 ft.?

3. Paint at 95¢ a quart is to be bought for the woodwork in a dining room. Allowing 1 pint for each door, ½ pint for each window, and 3 pints for the base board, what is the approximate cost if the room contains 3 doors and 3 windows?

4. At 20¢ a square foot, find the cost of a hardwood floor 14 ft. 6 in. by 16 ft. 3 in.

5. A house 18 ft. from the street is set on a building lot with a frontage of 50 ft. Find the cost, at 95¢ a square yard, for two walks, one on the street, made 1½ yards wide, and the other extending 18 ft. from the house to the street and made 1 yard wide.

*6. A walk is to be built 1½ yards wide on the two sides of a corner lot, having a frontage of 60 ft. on one street and 90 ft. on the other. Find the difference in the cost of a tar walk at 95¢ a square yard and that of a concrete walk at $1.75 a square yard. (Make a drawing of the walk.)

CHAPTER VIII. BUILDING A HOUSE

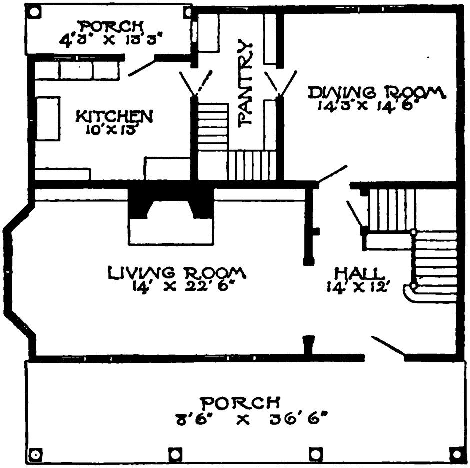
51. Study of the Architect's Plan

In drawing the plans for a house, the architect usually draws views of the exterior of the house to show what its appearance will be when finished. He makes plans of the basement and the different floors to show where the walls, windows, doors, and stairs are to be placed. He makes, besides, plans of sections to show the dimensions of each part and its method of construction.

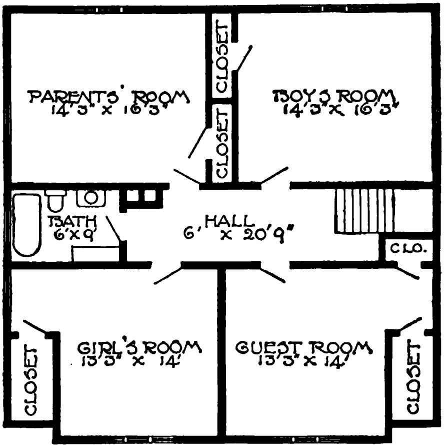
The frame of the house is built by laying on the foundation heavy timbers, called sills. Into these are fitted heavy cross timbers, called girders, which are supported by iron posts in the basement; and then floor timbers, called beams or joists. The upright pieces in the frame are called studding; the timbers in the roof, rafters; the diagonal supports, braces.

1. The sills, girders, and floor joists form the foundation for the floor and cannot be seen in the drawings given on page 114. The studding, rafters, and braces are shown in the front elevation of the house (page 115). Point them out.

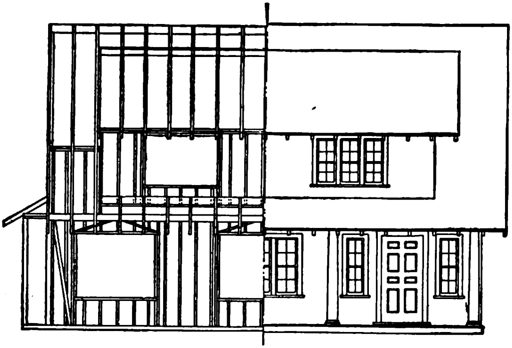
The Architect's Plan of the House



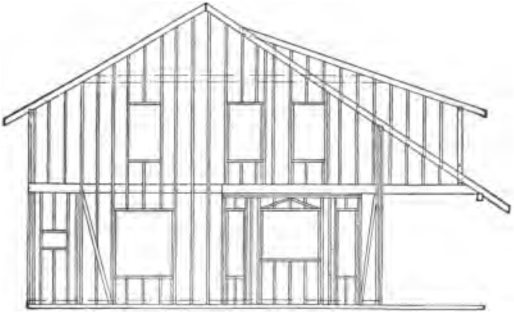
Plan of First Floor



Plan of Second Floor



Front Elevation



Side Elevation

2. The scale used in these plans is $\frac{1}{16}$ of an inch to a foot. Measure the front elevation to get approximately the width of the front of the house at the foundation, also, to get the length of the roof.

3. Measure the side elevation to get the approximate height of the house from the foundation wall to the gable peak. To get the width of the house at the foundation. To get the width of each roof.

4. Study the floor plans to find out the inside dimensions of each main room on the first floor. Of each on the second floor.

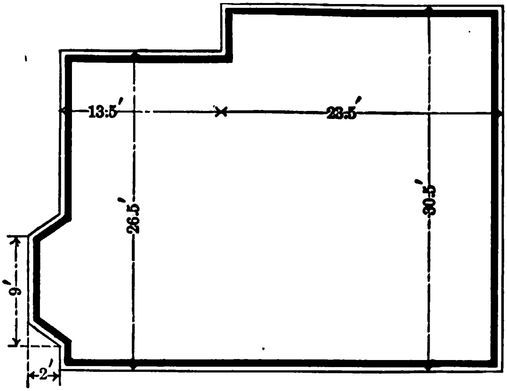
5. Draw an enlarged plan of the first floor, scale $\frac{1}{4}''$ to a foot.

*6. Draw to the same scale the plan for the second floor.

52. The Foundation of the House

[With pencil]

1. For convenience in working and to allow for plastering with cement, the excavation for the house is extended 6 inches beyond the outside walls. With the help of the plan given here, find the total area to be excavated.



Plan of Foundation

2. How many cubic yards are to be taken out if the excavation is carried to the depth of 6 feet?

3. Find the cost of the excavation at $1.00 a cubic yard.

4. The trench for the stone wall is equivalent to a trench 1.5 feet wide, 1 foot deep, 132 feet 8 inches long.[1] Find the cost of excavating the trench at the rate given in problem 3.

5. The porches are held up by 5 piers made of stone. Find the cost, at $1.50 a cubic yard, of the excavations for these piers, allowing for each an excavation 18″ by 18″ carried to a depth of 3.5′.

6. Find the total cost of the excavations.

*7. In estimating the number of cubic feet in the walls of a building, the outside dimensions are commonly used. This method counts the corners twice, but the extra labor required to build the corners offsets the double counting. The outside dimensions of the wall for length are as follows: 36′, 29′ 6″, 22′ 6″, 4′, 13′ 6″, 12′ 6″, 2′ 10″, 7′, 2′ 10″, 2′. The width of the trench is 1′ 6″; the depth, 1′. Find the cost of filling the trench with stone at an expense of $6.00 a perch. (1 perch = 25 cubic feet.)

---

[1] For the length of the trench (132′ 8″), the perimeter of the building was used.

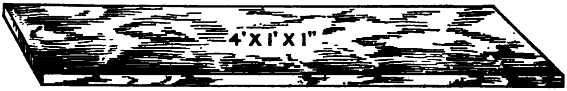
*8. The stone in the trench is laid without mortar. Above this, a mortar wall is built 5′ 6″ high. Find the cost of this at $10 a perch.

*9. Find the total cost of the foundation, including the cost of the excavation and the cost of the wall.

53. Outside Carpentry

I. Board Measure

A Board Foot



Four Board Feet

[Without pencil.]

Lumber is measured by board feet; that is, by a unit of measure 1 foot square and 1 inch thick.

1. A board 1 in. thick is 1 ft. wide and 10 ft. long. How many board feet does it contain?

2. How many board feet in a piece of lumber 1 in. thick, 1 ft. wide, and 8 ft. long? In one 12 ft. long?

3. How many board feet in a piece of lumber 1 in. thick and 6 in. wide when it is 10 ft. long? When it is 8 ft. long? When it is 12 ft. long?

4. A board 2 in. thick will contain how many times as many board feet as a board 1 in. thick, if the other dimensions are the same?

5. How many board feet in a piece of timber 12 ft. long, if the stock used is 3″ by 2″?

If the stock used is 3″ by 2″, the board is 12 ft. long, 3 in. ($\frac{1}{4}$ ft.) wide, and 2 inches thick. The number of board feet it contains equals:

12 (length in feet) × $\frac{1}{4}$ (width in feet) × 2 (thickness in inches).

The number of board feet = $12 \times \frac{1}{4} \times 2$, or ——.

Instead of expressing the width in feet as in the solution just given, the following form could have been used:

$$\text{Number of board feet} = \frac{12 \times 3 \times 2}{12}, \text{ or } \text{——}.$$

[Use pencil only when needed.]

6. A piece of lumber, 15 ft. long, 4 in. wide, and 2 in. thick contains how many board feet?

Find the number of board feet in:

7. A board 12 feet long of stock 2″ × 8″.
8. A board 12 feet long of stock 2″ × 6″.
9. A board 18 feet long of stock 2″ × 10″.
10. A piece of timber 12 feet long of stock 6″ × 8″.
11. A piece of studding 16 feet long of stock 2″ × 3″.

[With pencil.]

12. How many board feet are there in 10 pieces of stock 2″ × 8″, 16 feet long?

Compute the number of board feet:

13. In 30 rafters, 2″ × 6″, each 16 ft. long.
14. In 14 timbers, 6″ × 6″, each 18 ft. long.
15. In 10 girders, 6″ × 8″, each 18 ft. long.
16. In 24 boards, 3″ × 4″, each 12 ft. long.
17. In 12 boards, each 72 inches long, of stock 6″ × 1″.

The price of lumber is usually quoted as so many dollars per thousand board feet. A price of $65 M means that $65 is charged for each thousand board feet.

18. Find the cost of 1500 board feet at $65 M. Of 750 board feet at $60 M. Of 1250 board feet at $70 M.

19. Find the cost at $65 M of 100 pieces of 2″ × 3″ stock, each 12 ft. long.

II. THE FRAME

[With pencil.]

1. Sills 4″ by 6″ are to be placed, flush with the outside, on the foundation walls of the house pictured on page 113. The lengths required total 132⅔ linear feet. How many board feet are required? How much will the sills cost at $68 M?

2. For the girders, 36 linear feet of lumber 6″ by 6″ are required; for the porch sills, 70 linear feet 4″ by 6″. Find the cost of this lumber at $72 M.

3. With the help of the following list, find the cost of the floor beams at $70 M. For the first floor: 56 pieces 2″ × 8″ × 16′; 21 pieces 2″ × 6″ × 12′. For the second floor: 28 pieces 2″ × 8″ × 24′; 28 pieces 2″ × 8″ × 16′. For the attic: 40 pieces 2″ × 5″ × 18′.

4. The studding for the outside walls requires 130 pieces of lumber 2″ × 4″ × 20′; the first floor partitions require 78 pieces 2″ × 4″ × 9′; the second floor partitions, 100 pieces 2″ × 3″ × 9′. The studding is purchased at $65 M. Find the cost.

5. For rafters, the following is required: 21 pieces 2″ × 6″ × 22′; 25 pieces 2″ × 6″ × 20′; 6 pieces 2″ × 6″ × 14′. This lumber costs how much at $68 M?

*6. Find the total cost of the lumber for the frame of the house.

54. Rough Flooring and Sheeting

[With pencil.]

1. In building a house, the floors are made of rough boarding, upon which later are laid floors of more finely finished lumber. With the help of the plans on page 114, estimate the area of each floor to be covered with rough boarding.

2. The lumber used for the rough floors is 1 inch thick. Find the approximate cost at $60 M.

3. Sheeting is the name given to the boarding that encloses the house prior to putting on the exterior finish of shingles or clap-

boards. Lumber 1 inch thick is used. With the help of this drawing, find the number of board feet required to cover the surface of the gable end pictured.

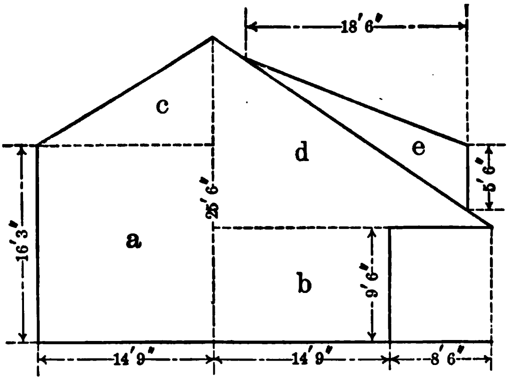


Diagram of Gable End

Suggestion: Before solving this problem, first express each dimension in feet and the decimal part of a foot, then write out an equation for the area of each rectangle and each triangle.

4. Deduct 80 sq. ft. for the openings for the windows and then make the same allowance of sheeting for the other gable end. How many board feet are required for the two ends?

*5. The front elevation requires 326 board feet of sheeting; the rear, 483 board feet; the roof, 2072. Add 5% for waste, and then find the cost of the sheeting for the entire house at $68 M.

55. Shingling

[With pencil.]

1. The areas on the roof to be shingled are as follows: on the rear roof, a rectangle 19′ 6″ by 40′; on the front roof, a rectangle 30′ 6″ by 40′, with a deduction of a rectangle 22′ by 28′ (the opening for the dormer window); on the dormer window, a rectangle 21′ 6″ by 32′. Find the total roof area to be shingled.

A square = a surface 10′ by 10′, or 100 sq. ft.

2. How many squares are there in the surface of the roof?

3. The shingles on the roof are to be laid so that 800 are required for each square. Find the number of shingles needed.

4. The area of the sides of the house, together with the dormer

and bay windows, is 2163 sq. ft. How many shingles, laid 600 shingles to the square, are required for this part of the house?

5. Shingles come in bundles of 250 each. Only whole bundles are sold. At $6.50 a thousand, how much must be paid for the shingles for the entire house?

*6. The sides of the house could be clapboarded at an expense for lumber of $6.00 per square.. The clapboards would cost how much more than the shingles?

56. Carpenter's Estimate and General Summary

I

In computing the cost of a house, estimates are often made, using as a basis the areas that the house contains. An estimate of $25 per square for floors means that an expense of $25 covers the cost of material and labor for each 100 square feet of flooring.

[With pencil.]

1. Count 1000 sq. ft. as the area of the flooring for the first story. Find the cost at the price quoted, $25 a square.

2. The estimate above includes the cost of the floor beams, the bridging (braces), and the under floor. An additional charge of $25 a square is made for a hard pine upper floor. How much is the estimated cost for the upper floor?

Find the cost:

3. Of the floors for the second story at $45 per square. Area covered, 1200 sq. ft.

4. Of the attic floor at $20 per square. Area, 80 sq. ft.

5. Of the porch floor at $35 per square. Area, 360 sq. ft.

6. Of shingling the roof at $30 per square. Area, 2072 sq. ft.

7. Of the wall frame, boarding and shingling at $30 per square. Area, 2163 sq. ft.

8. Of the inside studding for the first floor at $10 per square. Area, 702 sq. ft.

9. Of the inside studding for the second floor at $9.00 per square. Area, 800 sq. ft.

10. Of the porch ceiling at $18 per square. Area, 360 sq. ft.

11. To find the total cost of the carpentry, add to the items given in the ten problems above: $200 for front stairs; $25 for cellar stairs; $1072.41 for doors, windows, and interior finish; and $8.00 apiece for 4 colonial columns for the porch. What is the total cost of the carpentry for the house?

II

[With pencil.]

1. The concrete for the basement costs $1.20 a square yard. The area is computed as 1000 sq. ft. Find the cost.

2. The plastering for the house costs 70¢ a square yard. The area covered is 7022 sq. ft. What does it cost to have the house plastered?

3. To find the total cost of the house, add to the cost of the carpentry, the concrete, and the plastering the following items:

Staking out	$15.00
Excavation	252.32
Stone work	485.56
Chimney and brick work	150.00
Hardware	125.00
Heating (hot air)	400.00
Plumbing	475.00
Lighting	150.00
Painting and staining	450.00

What is the total cost of building the house?

CHAPTER IX. REVIEW

57. Progress Score

With the help of these tests measure your year's work in computing. Try to make 100 points on each test, counting for each correct answer the score given in parenthesis.[1]

I. Addition Test. [Copy problems only when necessary.]

$$\begin{array}{rrrrr}
\text{A. } 4 & \text{B. } 675 & \text{C. } 14325 & \text{D. } 17\frac{5}{12} & \text{E. } 34\frac{3}{4} \\
(5)\ 7 & (6)\ 438 & (7)\ 7432 & (5)\ \underline{28\frac{1}{12}} & (6)\ \underline{12\frac{3}{4}} \\
9 & 255 & 896 & & \\
3 & 476 & 2659 & \text{F. } 14\frac{1}{2} & \text{G. } 22\frac{11}{12} \\
6 & 359 & 42534 & (5)\ \underline{22\frac{3}{16}} & (7)\ \underline{17\frac{5}{6}} \\
5 & 624 & 6575 & & \\
7 & 371 & 3543 & & \\
6 & 544 & 54298 & \text{H. } 12\frac{3}{4} & \text{I. } 42\frac{1}{6} \\
5 & \underline{765} & \underline{96759} & (6)\ \underline{47\frac{1}{5}} & (8)\ \underline{27\frac{8}{9}} \\
7 & & & & \\
8 & & & & \\
\underline{8} & & & &
\end{array}$$

J. [Write answer without copying.] $8.96 + $.74 + $9.69 = ?
(6)

[Copy in column form and find answers.]

K. (8) $118\frac{5}{12} + 144\frac{5}{6} + 327\frac{5}{8} = ?$

L. (6) $33.72 + $14.22 + $119.85 + $7.46 + $38 + $87.92 = ?

M. (8) $1.18 + 75¢ + $8\frac{1}{2}$¢ + $4\frac{3}{4}$¢ + 9 mills + $4\frac{1}{2}$ mills = ?

N. (6) .145 + .042 + .39 + .127 + .183 + .74 = ?

O. (11) $6.32 + 8.21 + .05\frac{1}{2} + .04 + 3\frac{1}{8} + 2\frac{3}{4} = ?$

II. Subtraction Test. [Copy problems only when necessary.]

$$\begin{array}{rrrrr}
\text{A. } 324397 & \text{B. } 710050 & \text{C. } 43\frac{5}{6} & \text{D. } 24 & \text{E. } 17\frac{2}{5} \\
(5)\ \underline{59408} & (6)\ \underline{164247} & (6)\ \underline{19\frac{1}{6}} & (7)\ \underline{9\frac{2}{3}} & (8)\ \underline{12\frac{4}{5}} \\
\text{F. } 42\frac{1}{12} & \text{G. } 25\frac{2}{9} & \text{H. } 44\frac{7}{12} & \text{I. } 442\frac{1}{4} & \text{J. } \$30.00 \\
(6)\ \underline{15\frac{3}{4}} & (9)\ \underline{8\frac{2}{3}} & (7)\ \underline{18\frac{1}{8}} & (9)\ \underline{243\frac{1}{3}} & (5)\ \underline{4.74}
\end{array}$$

K. (8) $10 − $12\frac{1}{2}$¢ = ?

L. (6) 16.872 − 8.29 = ?

M. (7) 74.62 − 9.874 = ?

N. (11) $62\frac{4}{5} - 48.54\frac{1}{4} = ?$

---

[1] See directions, also the footnote, page 37.

III. Multiplication Test. [With pencil.]

A. $\begin{array}{r}6870\\ \underline{9}\end{array}$ (5)

B. $\begin{array}{r}7658\\ \underline{37}\end{array}$ (6)

C. $\begin{array}{r}4390\\ \underline{6080}\end{array}$ (6)

D. $32 \times \frac{3}{4} = ?$ (3)

E. $\frac{5}{8} \times 125 = ?$ (7)

F. $\begin{array}{r}21\frac{2}{5}\\ \underline{7}\end{array}$ (9)

G. $\begin{array}{r}156\\ \underline{2\frac{2}{3}}\end{array}$ (11)

H. $\begin{array}{r}120\\ \underline{21\frac{3}{4}}\end{array}$ (12)

I. $\frac{7}{8} \times \frac{4}{21} = ?$ (5)

J. $1\frac{7}{8} \times 1\frac{2}{9} = ?$ (8)

K. $\begin{array}{r}17.42\\ \underline{12.4}\end{array}$ (8)

L. $\begin{array}{r}.018\\ \underline{.25}\end{array}$ (8)

M. $3.14 \times 1.4\frac{2}{7} = ?$ (12)

IV. Division Test.

A. $7\overline{)68653}$ (4)

B. $92\overline{)466440}$ (5)

C. $58\overline{)44312}$ (6)

D. $173\overline{)120235}$ (9)

E. $16 \div \frac{2}{5} = ?$ (5)

F. $\frac{2}{3} \div \frac{3}{4} = ?$ (5)

G. $\frac{11}{12} \div 3 = ?$ (5)

H. $6\frac{1}{4} \div 5 = ?$ (6)

I. $7\frac{1}{2} \div 3\frac{3}{4} = ?$ (7)

J. $48\overline{)\$19.69}$ (8)

K. $3.4\overline{).1428}$ (7)

L. $.009\overline{)2.916}$ (5)

M. $.25\overline{)1875}$ (8)

N. $4000\overline{)\$36}$ (8)

O. $\frac{4\frac{1}{2} \times (700 - 12.25)}{1.25} = ?$ (11)

58. Review of Percentage

Find: [Use pencil only when needed.]

1. 3% of: 400; 2000; 10000.
2. 2% of: 300; 4000; 30000.
3. ½% of: 200; 400; 800.
4. 4% of: 100; 3000; 12000.
5. 25% of: 800; 4000; 32000.
6. 12½% of: 800; 16000; 40000.
7. 33⅓% of: 900; 3000; 24000.
8. 50% of: 400; 8000; 20000.
9. 5% of: 700; 1000; 20000.
10. 7% of: 200; 5000; 40000.
11. 6% of: 800; 9000; 10000.
12. 16⅔% of: 600; 12000; 30000.
13. 75% of: 800; 4000; 80000.
14. 37½% of: 800; 4000; 80000.
15. Increase by 100%: 300; 40; 2000; 240; 32000.
16. Increase by 50%: 400; 20; 6000; 120; 30000.
17. Decrease by 20%: 500; 25; 10000; 150; 25000.

18. Express as per cents: $\frac{120}{240}$; $\frac{25}{75}$; $\frac{20}{160}$; $\frac{24}{64}$; $\frac{8}{200}$; $\frac{12}{600}$; $\frac{9}{400}$.

[With pencil.]

19. Increase: 7200, 8%; 4250, 6%; 650, $4\frac{1}{2}$%; 5450, $3\frac{1}{2}$%.

20. Express as a per cent the ratio of 42 to 6000. Of 115 to 500. Of 46 to 720.

21. Find the number of which 5% is 128. Of which $3\frac{1}{2}$% is 70. Of which $4\frac{1}{2}$% is 180. Of which 25% is 172.75. Of which $12\frac{1}{2}$% is 87.6. Of which $66\frac{2}{3}$% is 480. Of which 150% is 7500.

59. Town and City Improvements

I

Many towns and cities are making and carrying out plans for improvements. Trees and shrubs are being set out along the streets; recreational parks and playgrounds are being provided; schools and libraries are being improved; and means of securing progress in business and in industry are being studied and worked out.

Name improvements that are being made in your town or city.

II

Among the conditions that affect the health of a town or a city are the open spaces for fresh air and sunshine, the purity of the water supply, and the freshness and cleanliness of the milk and other foods used.

[With pencil.]

1. To improve the health of the children in Philadelphia, the city spent in a recent year $57,149.40 for the support of playgrounds. The total attendance was 1,371,315. The expense per person was how much?

2. New York City spent in the same year $.0138 for each child attending the park playgrounds. The total attendance was 3,142,115. What sum of money was spent on the playgrounds?

3. A crowded city extended its boundaries, and laid out parks and pleasant residential districts. By so doing, the city decreased its annual death rate of 33 persons per thousand to 18 persons per thousand. This meant the saving of how many lives annually, when the population was 270,000? Without counting any increase in population, the number of lives saved in 10 years amounted to how many?

4. The effect of crowding families into small quarters is seen from the following facts taken from the report of another large city: Among the 73,000 persons living in one-room tenements, there were in one year 11,935 deaths; among the 382,000 persons living in two-room tenements, there were 8550 deaths; among the 432,000 persons living in three-room tenements, there were 3240 deaths. Find the rate per thousand for each kind of tenement.

5. By improving the milk supply in a city, the death rate of 40 per thousand among children under five years of age was decreased 60%. This decrease meant the saving of how many lives in a population of 5500 children under the age given?

6. In one year, a town had 120 cases of typhoid. By filtering the water supply, the number of cases was reduced so that the next year there were only 15. This number was what per cent of the former?

7. During an epidemic of typhoid in one of our great cities there were 5421 cases and 622 deaths, all of which might have been prevented by the expenditure of $2,500,000 in improving the water supply. It was computed that the loss of wages from sickness cost the people $26,900; the loss of life was put at $2,448,000; and other expenses were estimated at $677,000. The loss was how much greater than the cost of the improvements would have been?

60. Fire Protection

[Use pencil only when needed.]

1. In one country, the loss from fire in a recent year averaged 48¢ per person. In the United States, for the same year, it was 500% of that amount. What was the loss per person in the United States? What did this sum amount to for each 1000 inhabitants?

2. Many of the causes of fire are those that can be prevented. This is shown from the following typical town report: In July of one year in this town, there were 30 fires. Of these, 5 were caused by firecrackers; 6, by piles of rubbish; 3, by children playing with matches; 2, by cigar stubs; and 14 were due to miscellaneous causes. What per cent of the number was caused by firecrackers? By piles of rubbish? By children playing with matches?

3. The annual fire loss in the United States from brick buildings and their contents was recently $68,000,000; from frame buildings and their contents, $147,000,000. The loss from fires occurring in frame buildings was what per cent of the total loss?

4. One of our large cities having a population of 670,000 had in one year 2136 fires with an average loss of $2019 per fire. The loss was how much per capita?

5. Of the 2136 fires, 436 came from overheated stoves; 404, from grass and rubbish; and 154, from smokers' carelessness. Find what per cent of the total number of fires was due to these three causes.

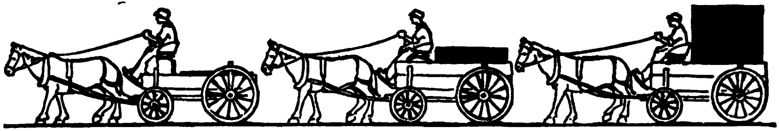
6. A small city spent on its fire department as follows: for salaries, $53,013; for miscellaneous expenses, $3757; for hay and grain, $5498; for auto supplies, $796; for repairs, $623; for exchange of horses, $440; for hose, $1199. What were the total expenses?

7. During the same year, fires occurred in property valued at $1,691,195. The loss from the fires was $89,358. The sum of the loss and the expense of the fire department was how much less than the total value of the property in which the fires occurred?

*8. The insurance paid on the fires was $75,142. This was what per cent of the losses from the fires?

*9. With the help of your own town report or that of a neighboring city, find: (1) the total value of the property destroyed by fire in one year; (2) the loss per capita of population; (3) the per cent of the total number of fires caused by carelessness with matches and other unnecessary causes.

61. Economy in Good Roads



Over an Earth Road   Over a Macadam Road   Over Asphalt

[Use pencil only when needed.]

1. A horse capable of hauling a given load over an earth road can haul a load about $2\frac{1}{2}$ times as heavy over a macadam road or 5 times as heavy over an asphalt pavement. At this rate, a horse capable of hauling $\frac{3}{4}$ of a ton over an earth road can haul how heavy a load over a macadam road? Over one paved with asphalt?

2. A team of mules capable of hauling a wagon loaded with 4 bales of cotton over an earth road would require how many trips to haul 50 bales over a macadam road, if the team exerted the same amount of force each time?

3. The cost of gasoline for a motor truck carrying a given load is $3\frac{1}{2}$¢ a mile on a macadam road. Find the cost of carrying a load of equal weight 40 miles over an asphalt road. (See problem 1 for relative weights of load.)

4. The cost of carrying the load is how much less over the asphalt road then over the macadam road?

5. A farmer lives 3 miles from a railway station. Allowing $9.50 as the expense for a man and team per day, find the expense of hauling to the railway station 700 bu. of wheat with 35 bu. to the load and four trips per day.

6. A macadam road put through the farming country reduces 60% the expense of hauling. Find the expense saved the farmer per bushel. (See problem 5.)

7. A good road through a farming country increased the value of the land in a certain district $5.75 per acre. This is what per cent increase on land previously valued at $65 an acre?

62. The Cost of Running Automobiles and Trucks

The chief expenses in owning an automobile are for tires, gasoline, oil, and repairs. In reckoning the cost, it is necessary to take account, also, of the interest on the money invested, and of the depreciation or lowered value of the car from year to year.

[Use pencil only when needed.]

1. The owner of a small touring car bought for $525 traveled in one year 5000 miles at a total expense of $262.50. His car cost him how much a mile?

Another man bought a car for $1200. From the following list, find the cost per mile of each item for his car.

2. Gasoline at 28¢ a gallon; 18 miles to the gallon.

3. Oil at 25¢ a quart; 100 miles to the quart.

4. Tires at $120 a set; 6000 miles to one set of tires.

5. Total for repairs, interest and depreciation for the season, $435. Distance covered, 6000 miles.

6. What was the total cost per mile of the $1200 car?

7. The cost per mile was how much greater for the $1200 car than for the $525 car?

8. From the following list find the cost per mile of running a 2-ton truck: Tires, $.0599; gasoline, $.0416; oil, $.0033; other lubrication, $.0018; repairs, $.0200; over-hauling, $.0330; depreciation, $.0311.

9. Allowing 50 miles as the distance covered in a day, what is the cost per day for the items included in problem 8? If you add to this cost, an expense of $7.52 a day for the driver, garage rent, insurance and interest, what is the total cost of the truck per day?

10. To do the work of one 2-ton truck, it was necessary for a man to employ two teams of horses at a cost of $12 a team per day. The cost of hauling the goods by the truck was approximately what part of hauling them by horse and wagon? What per cent?

*11. The total cost of a 5-ton truck is counted as $19.85 per day. This is how much less per ton than the total cost of the 2-ton truck (see problem 9)?

63. Problem Review and Test[1]

[Use pencil for drawings only.]

1. At the rate of \$4.00 for an 8-hour day, how much is due a man for 6½ hours of work?

2. What is the difference in the wages for an 8-hour day for a skilled workman earning 75¢ an hour, and those of a man earning 50¢ an hour?

3. Find the smallest number of bills and coins required to pay a workman \$4.92. To pay 10 workmen each \$4.85.

4. I buy from a grocer 2 lb. of butter at 60¢ a pound, a package of sugar for 50¢. In paying the bill, how much change should I receive from a five-dollar bill?

5. Spring chickens are selling at 40¢ a pound. Find the cost of two, one weighing 2½ lb., the other weighing 2¾ lb.

6. How much more expensive is a 10-pound turkey selling at 55¢ a pound than 2 ducks each weighing 5 lb. and selling at 50¢ a pound?

7. Summer clothing is offered at a discount. How much more must be paid for a suit of clothes marked \$40.00 with 20% off than for one marked \$30.00 with 33⅓% off?

8. A house rents for \$40 a month. This is how much a year?

9. How much more must be paid for an apartment in a year when renting it by the week at \$10 a week than when renting it by the month at \$40 a month?

10. Out of an income of \$1200 a family saves each year 12%. This amounts to how much a month?

---

[1] Pupils should be able to answer, also, questions such as the following, covering the various types of problems studied: What is a rectangle? How is the area of a triangle found? How is the perimeter of a rectangle found from the area and one dimension? How can the number of square yards be found in a rectangular surface 12½ feet by 16 feet? How is the interest in a given sum of money found for 3 months at 5%? etc. These problems should be given both with and without numbers, but no computations required.

11. A man leaves $500 to draw interest in a bank at 3%. How much money can he withdraw at the end of 6 months?

12. A rectangular building lot is 40 ft. wide and 80 ft. deep. In drawing a plan of the lot to a scale of 10 feet to $\frac{3}{8}$ of an inch, what should be the dimensions of the rectangle?

13. Construct a right-angled triangle with a base of 3 in. and an altitude of 5 in. What is its area?

14. Construct an isosceles triangle with a base of 3 in. and an altitude of $2\frac{1}{2}$ in. The area of this triangle is what part of that of the right-angled triangle in problem 13?

15. A parallelogram with an altitude of 6 in. has a base of 10 in. Find its area.

16. Find the area of a trapezoid with an altitude of 4 in., having its parallel sides respectively 8 in. and 10 in. long.

17. A printer is to cut a sheet of cardboard 22″ by 28″ into cards 3″ by 5″. Find the largest number that can be cut from the sheet. (Make a drawing.)

[With pencil.]

18. A class-room is 28 ft. long, 25 ft. wide, and 12 ft. high. The class that occupies it has a register of 40 pupils. Each pupil has how many square feet of floor space? How many cubic feet of air space?

19. A building lot 40 feet wide and 120 feet deep is bought for $400. At what price per square foot must it be sold to make a profit of 8% on the cost?

20. A rectangular garden containing 5100 sq. ft. is 42.5 ft. wide. What is the length of the garden? How many yards are there in its perimeter?

21. A house that rents for $50 a month costs its owner $120 for taxes and $75 for repairs during the year. There is a mortgage of $3000 on which he pays 5% interest. The rent comes to how much more than the expenses?

22. A man found that the total cost of running his automobile 6000 miles came to $715.20. Find the approximate and then the exact cost per mile.

23. A sum of $500 is left to draw interest for 3 months in a bank paying 4½% on deposits. Find the amount that can be withdrawn from the bank at the end of the period.

24. What is the interest on $3000 at 4% for 90 days?

25. Find the interest on $1800 at 5% from April 15 to September 15 in the same year, computing the time by counting the exact number of days.

26. A merchant sells an overcoat at retail for $48. Of the amount received, 20% goes to pay the cost of the material used in its manufacture; 30% goes to labor; 5%, to other manufacturing expenses; 5%, to the manufacturer's profit; 10%, to transportation; 5%, to the wholesale dealer; and 20%, to help pay the running expenses of the retail store. First find the amount of each item, and then the balance, which is the retail dealer's profit.

27. A retail candy dealer buys at wholesale, at 45¢ a pound, chocolates that he sells at retail at 80¢ a pound. It costs him 15¢ a pound to sell the candy. His profit is what per cent of the wholesale price? What per cent of the retail price?

28. The distance from New York to San Francisco by way of Panama is 5305 nautical miles; by way of the Straits of Magellan, 13,244 nautical miles. A vessel traveling at the rate of 18.5 nautical miles per hour will save how many days of travel by taking the shorter route?

*29. It is estimated that good roads save a farmer annually an expense of 75¢ an acre. At this rate, a year's saving is what per cent of the cost of ten miles of road, if the cost per mile is $1100, the number of farms on the road is 32, and the average number of acres in each farm is 200?

PART SIX

CHAPTER I. ACQUIRING SKILL IN THE FUNDAMENTAL PROCESSES

1. Computing Accurately

Dept. **Sales No.** **Name**

	JAN.					**FEB.**					**MAR.**					**APR.**					**MAY**					**JUNE**				
Inspectors																														
Auditing																														
Credit																														
Retail																														
Wrong Address																														
Late																														
Total																														
Reported																														

A large department store keeps on file a card like the above, filled out for each employee. Whenever an employee is late, or is reported for discourteous treatment of a customer, or *makes an error*, he is marked accordingly on the card. If many such charges are made against his name, he is warned by the head of his department; and if his record shows no improvement, he is discharged. Employees whose records are free from such charges are considered for promotion when an opening occurs.

If you go into business, your record will be noted, either in a similar way or mentally, by your employers. What qualities besides promptness will help you to succeed in business or in other work? Which of these qualities does arithmetic give you the opportunity to develop?

Pupils in this grade should aim for absolute accuracy in all their figuring. In the business world no other standard is accepted.

2. Short Methods in Computing

One way of acquiring accuracy is to have a short method of work that may be used either for solving a problem or as a means of checking a result found in some other way.

I

In adding 78 and 24 without a pencil, it is convenient to think: $78 + 20 = 98$. $98 + 4 = 102$. In adding $3.40 to $5.70, it is convenient to think: $5.70 + $3.00 = $8.70. $8.70 + $.40 = $9.10.

When shopping, a woman bought one pair of gloves for $1.75 and another pair for $2.50. In finding the amount due, she thought: $1.75 + $2.00 = $3.75 + $.50 = —.

Write answers only:

1. 44 + 37 = ?
2. 68 + 26 = ?
3. 75 + 68 = ?
4. 37 + 35 = ?
5. 38 + 72 = ?
6. 350 + 260 = ?
7. 270 + 450 = ?
8. 505 + 240 = ?
9. 748 + 150 = ?
10. 450 + 75 = ?
11. \$3.75 + \$2.50 = ?
12. \$6.40 + \$3.80 = ?
13. \$7.20 + \$4.50 = ?
14. \$9.60 + \$.48 = ?
15. \$3.48 + \$4.90 = ?

II

Review page 17, then give a short way of multiplying 24 by 25. By $12\frac{1}{2}$. By $16\frac{2}{3}$. By $33\frac{1}{3}$. By $66\frac{2}{3}$.

[With pencil.]

Multiply the numbers in each column by the number in black type at the top, using a short method wherever it is convenient:

	25	**$12\frac{1}{2}$**	**$33\frac{1}{3}$**	**$66\frac{2}{3}$**	**$16\frac{2}{3}$**
(*a*)	896	1672	1800	3300	780
(*b*)	4794	9784	7680	1575	672
(*c*)	12792	67840	5685	465	5490
(*d*)	39798	7300	4975	9.69	8940
(*e*)	42.98	38.695	1.254	.0144	462

III

[With pencil.]

In adding or subtracting numbers where fractions occur, it is sometimes convenient to change the common fractions to decimals and sometimes convenient to add or subtract the fractions after reducing them to a common denominator. Solve each of the following problems by the most convenient method:

1. $640.25 + 304\frac{1}{2} + 148\frac{2}{5} = ?$
2. $87.5 + 94\frac{3}{4} + 22\frac{1}{20} + 4\frac{3}{10} = ?$
3. $18\frac{1}{5} + 32\frac{1}{2} + 34\frac{7}{10} + 12\frac{3}{5} = ?$
4. $88\frac{5}{6} + 18\frac{2}{3} + 24\frac{5}{8} + 19\frac{3}{4} = ?$
5. $64\frac{1}{16} + 55\frac{7}{8} + 44\frac{3}{4} + 25\frac{1}{2} = ?$
6. $72.75 - (18\frac{1}{2} + 12\frac{1}{4}) = ?$
7. $48\frac{1}{2} - (8\frac{3}{4} + 9\frac{7}{10}) = ?$
8. $75 - (15\frac{3}{10} + 14\frac{3}{4}) = ?$
9. $(43\frac{3}{8} - 7.3) + (8.6 - 2\frac{7}{16}) = ?$
10. $18\frac{5}{16} - (4\frac{3}{4} + 3\frac{7}{8}) = ?$
11. $63.3\frac{1}{3} - (24\frac{3}{10} + 8\frac{4}{5}) = ?$
12. $(7.4 + 2\frac{11}{20}) - (6\frac{7}{8} - 2.125) = ?$

13. Multiply by 4.5:[1] 24; 460; 1580; 16.48; 284.9; .074.
14. Multiply by 3.25: 448; 1240; 1792; 46.92; .0128.
15. Multiply by .75: 320; 1472; 1600; 7.488; .0096.

IV

Find answers, using a short cut wherever possible:

1. $720 \times 33\frac{1}{3} = ?$
2. $8000 \times 25 = ?$
3. $2400 \times 12\frac{1}{2} = ?$
4. $\frac{7}{8} \times 640 = ?$
5. $720\frac{8}{10} \times 100 = ?$
6. $14.5 \times \frac{2}{5} = ?$
7. $16\frac{1}{2} \times \frac{7}{10} = ?$
8. $75000 \div \frac{3}{4} = ?$
9. $1500 \div 1\frac{1}{2} = ?$
10. $48000 \div 3000 = ?$
11. $(8000 + 5500) \div 500 = ?$
12. $640.8 \div (8\frac{7}{8} - 3\frac{3}{4}) = ?$
13. $40 \times (12.5 + 17\frac{1}{5}) = ?$
14. $(24.2 - 3\frac{4}{5}) \times 90 = ?$
15. $60 \times \frac{5}{12} \times \frac{8}{25} = ?$
16. $8\frac{1}{2} \times 1\frac{2}{5} \times 120 = ?$
17. $(12\frac{1}{2} \times 640) \div 80 = ?$
18. $(720 \times \frac{7}{8}) \div (4 \times 22\frac{1}{2}) = ?$

Find answers, writing as few figures as possible:

19. $15\frac{2}{3} \times 6$.
20. $24\frac{3}{4} \times 4$.
21. $32\frac{1}{8} \times 12$.
22. $180\frac{1}{3} \times 9$.
23. $375\frac{1}{2} \times 7$.
24. $480 \times \frac{1}{16}$.
25. $9600 \times \frac{1}{4}$.
26. $240 \times \frac{5}{8}$.
27. $175 \times \frac{3}{5}$.
28. $1250 \times \frac{7}{10}$.
29. $1200 \times 1\frac{1}{2}$.
30. $15000 \times 3\frac{2}{5}$.
31. $64 \times 1\frac{7}{8}$.
32. $350 \times 2\frac{4}{7}$.
33. $160 \times 3\frac{1}{4}$.
34. $142.5 \times 4\frac{1}{2}$.
35. $64.25 \times 5\frac{1}{10}$.
36. $.625 \times 800$.
37. $560 \times .375$.
38. $92.4 \times 16\frac{2}{3}$.
39. $300 \div \frac{3}{16}$.
40. $2700 \div \frac{3}{4}$.
41. $25\frac{5}{8} \div 5$.
42. $720\frac{6}{7} \div 6$.
43. $440 \div 1\frac{1}{3}$.
44. $320 \div 6\frac{1}{4}$.
45. $120 \div 3\frac{1}{3}$.
46. $1998 \div 900$.
47. $775 \div 250$.
48. $18.25 \div 40$.

---

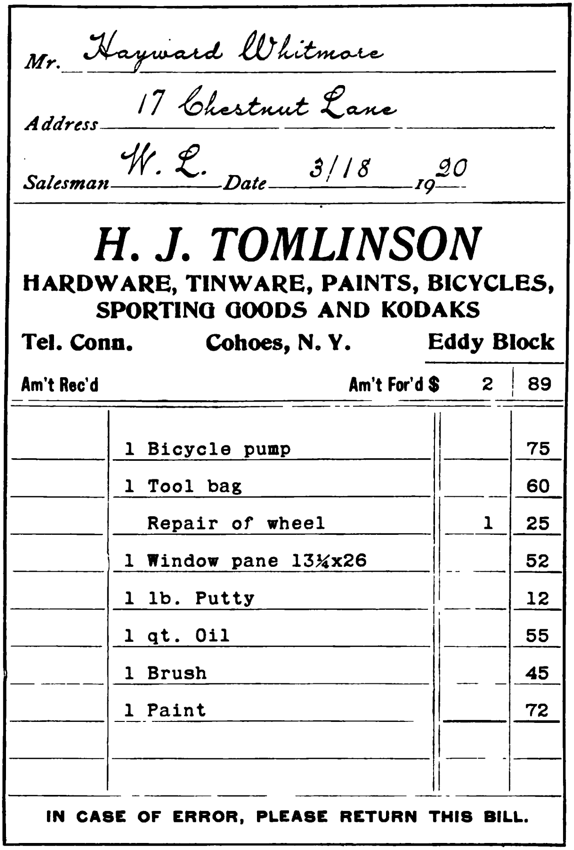
[1] Since it is easier to divide by 2 than to multiply by 5, it is often convenient to write such a multiplier as 4.5 as $4\frac{1}{2}$. For a similar reason, it is often convenient to write 3.25 as $3\frac{1}{4}$, and .75 as $\frac{3}{4}$.

CHAPTER II. COMMON BUSINESS FORMS

3. The Salesman's Check and the Monthly Statement

In buying goods at retail, the purchaser usually receives a **salesman's slip** or **check**.

This is a form filled out by a clerk when the purchase is made. It gives the date, the clerk's number or initials, the amounts and prices of goods sold, and the total amount of the purchase. By the aid of carbon paper, two or more copies are made at one time. One is kept by the clerk as the record of the sale; another is taken by the



Mr. Hayward Whitmore

Address 17 Chestnut Lane

Salesman W. L. *Date* 3/18 *19*20

H. J. TOMLINSON

HARDWARE, TINWARE, PAINTS, BICYCLES,
SPORTING GOODS AND KODAKS

Tel. Conn. **Cohoes, N. Y.** **Eddy Block**

Am't Rec'd	**Am't For'd $**	2	89
	1 Bicycle pump		75
	1 Tool bag		60
	Repair of wheel	1	25
	1 Window pane 13¼x26		52
	1 lb. Putty		12
	1 qt. Oil		55
	1 Brush		45
	1 Paint		72

IN CASE OF ERROR, PLEASE RETURN THIS BILL.

Salesman's Check

purchaser as a means of checking goods bought and of identifying goods if they are returned. If a bill is paid, it is so stated on the slip.

When goods are not paid for at the time of purchase, the items are carried on the dealer's books, and a bill is sent to the customer at the end of the month. Such a bill is called **a monthly statement.**

All bills should be paid promptly within a few days after they are received. In this way a person's "credit" is kept good; other dealers will be glad to have him open charge accounts and will accommodate him in every possible way.

Monthly statements often have three columns at the right. The first column gives the prices of goods by items; the second column, the total of the daily purchases; and the third, the value of goods returned and credited to the customer's account. The credit items are often typewritten in red ink to distinguish them from the charges.

It is customary to omit decimal points to show cents in bills; dollars and cents are shown by position and by spacing.

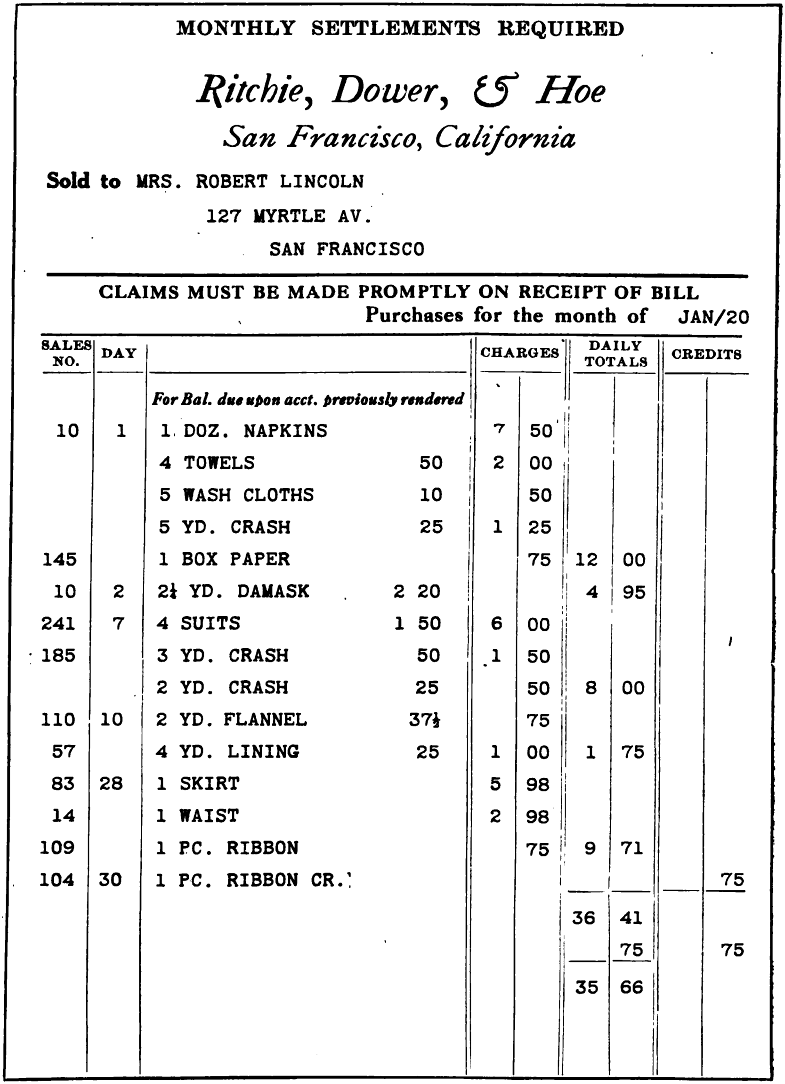
A monthly statement is receipted when, on being paid, the name of the person or firm to whom the bill was owed is written or stamped on the bill, with the words "Received payment" and the date.

In the statement opposite, Mrs. Robert Lincoln is the person who owes the money to the firm, Ritchie, Dower, and Hoe.

[Use pencil only when needed.]

1. From the salesman's check on page 137, give the name of the purchaser. Give his address. The initials of the salesman. The date of the purchase. The total amount of the purchase. With the amount forwarded, how much was due on the account?

2. Study the monthly statement given on page 139. Give the name and address of the purchaser. From whom were the goods purchased? Name the total amount of each day's purchases; the total amount of the bill; the amount of the credit charge. For what month, in what year, was the bill rendered?



MONTHLY SETTLEMENTS REQUIRED

Ritchie, Dower, & Hoe

San Francisco, California

Sold to MRS. ROBERT LINCOLN
127 MYRTLE AV.
SAN FRANCISCO

CLAIMS MUST BE MADE PROMPTLY ON RECEIPT OF BILL

Purchases for the month of JAN/20

SALES NO.	DAY			CHARGES		DAILY TOTALS		CREDITS	
		For Bal. due upon acct. previously rendered							
10	1	1 DOZ. NAPKINS		7	50				
		4 TOWELS	50	2	00				
		5 WASH CLOTHS	10		50				
		5 YD. CRASH	25	1	25				
145		1 BOX PAPER			75	12	00		
10	2	2¼ YD. DAMASK	2 20			4	95		
241	7	4 SUITS	1 50	6	00				
185		3 YD. CRASH	50	1	50				
		2 YD. CRASH	25		50	8	00		
110	10	2 YD. FLANNEL	37½		75				
57		4 YD. LINING	25	1	00	1	75		
83	28	1 SKIRT		5	98				
14		1 WAIST		2	98				
109		1 PC. RIBBON			75	9	71		
104	30	1 PC. RIBBON CR.							75
						36	41		
							75		75
						35	66		

Monthly Statement

Find the amount due: [Use pencil only when needed.]

3. A grocer fills out a check for the following telephone order: 1 basket of Concord grapes at \$.30, 1 box of sugar at \$.50, 3 loaves of bread at \$.10 a loaf, 3 lb. of butter at \$.60 a pound, 1 peck of potatoes at \$2.00 a bushel.

4. Robert Brown buys at a men's furnishing store: 6 collars at \$.25, 2 neckties at \$.75, and ½ doz. handkerchiefs at \$3.00 a dozen.

5. William Long buys from a clerk in a hardware store: 2 doz. screws at \$.10 a dozen, 3 packages of tacks at \$.10, 1 tack-hammer at \$.25, and 2 rolls of picture wire at \$.15 a roll.

6. Elizabeth Johnson buys at a dry-goods shop: ¼ yd. of silk at \$1.80 a yard, 6 spools of cotton thread at \$.08, 2 papers of needles at \$.10, and 1 box of dressmaker's pins at \$.25.

7. A monthly statement is received for groceries amounting to \$20.48, with credit charges to be deducted amounting to \$2.25. What is the balance due?

8. What change should be received from a ten-dollar bill in paying a monthly bill for 30 qt. of milk at 16¢ a quart, and 5 jars of cream at 24¢ a jar?

9. Which merchant can offer goods at the lowest prices, the one whose customers pay promptly or the one whose customers delay so long in paying their bills that the merchant has to borrow money to meet his own bills?

10. Give arguments for and against running a charge account.

[With pencil or pen.]

11. Make out and receipt the following bill: Thomas Brown buys of A. G. Spaulding and Co. of New York: Sept. 14, 4 tennis rackets at \$2.50; Sept. 17, 1 sweater at \$7.50; Sept. 24, 1 football suit at \$8.00, and 1 football at \$5.00. He returns 1 tennis racket at \$2.50, on Sept. 17. The bill is dated Oct. 1. Thomas Brown pays the bill Oct. 4.

12. The Edgewood Nursery Company sold to Timothy Ryan, 47 University St., Providence, R. I.:

3 White Birch Trees	@	$1.50
2 Catalpas	@	2.25
6 Norway Maples	@	2.35
3 Crimson Ramblers	@	.75
5 Selected Hardy Vines	@	.50
12 Miscellaneous Shrubs	@	.50

Find the amount of the bill.

13. Complete this grocery statement and find the total amount of the bill:

Jan.	2	Yeast 03 Eggs 65 Sugar 1.00				
	3	Oil 20 Gelatin 15				
		Cheese 28 Lettuce 08 Saltines 15				
	7	1 bu. Potatoes 2.00 Soap 50				
		Raisins 24 Dutch Cleanser 20				
	9	Yeast 03 Bag Flour 1.65				
		Coffee 45 Peas 22 Corn 20				
	12	Celery 18 Cranberries 28 Lard 35				
	16	Apples 75 Can Beans 15				
	19	Oranges 60 Cream 24 Mustard 15				
	23	Baking Powder 45 Box Fish 27				
	24	Bag Flour 1.65 Coffee 45 Hominy 20				
	27	Bread 10 Oranges 50 Molasses 50				
	28	Bananas 40 Onions 20				
	31	Chocolate 50 Prunes 40 Cheese 28				

***14.** Bring monthly statements from home. See if you can find a mistake in any one of them. Housekeepers often save money by looking over bills carefully to detect mistakes.[1]

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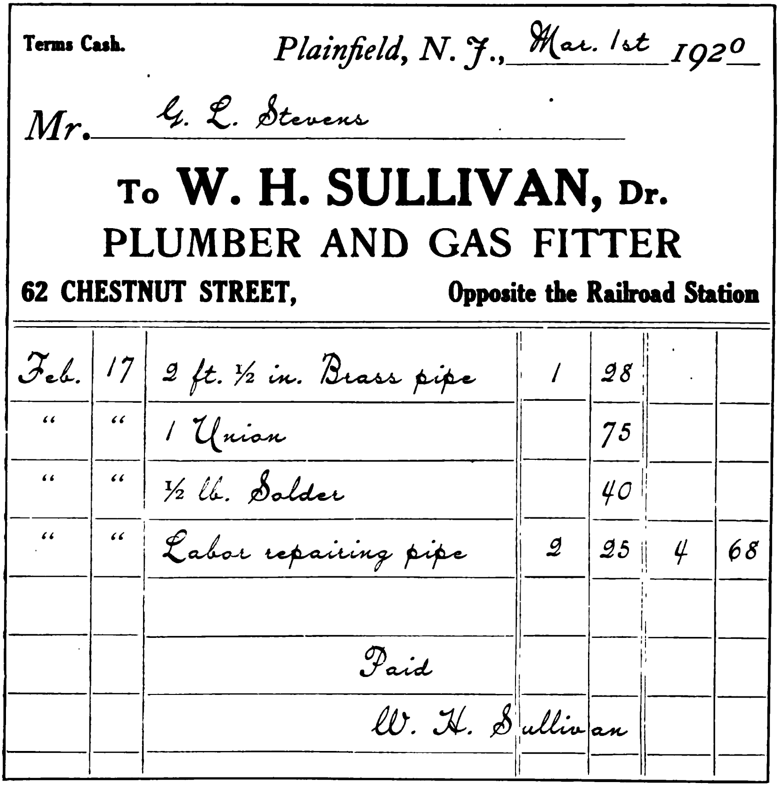
[1] All problems starred throughout the book are intended to be optional work.

4. Bills and Invoices

Besides salesmen's slips and monthly statements, there are bills for all sorts of goods purchased and for services rendered. The following form is one commonly used:



Terms Cash. *Plainfield, N. J.,* Mar. 1st 1920

Mr. G. L. Stevens

To **W. H. SULLIVAN,** Dr.

PLUMBER AND GAS FITTER

62 CHESTNUT STREET, **Opposite the Railroad Station**

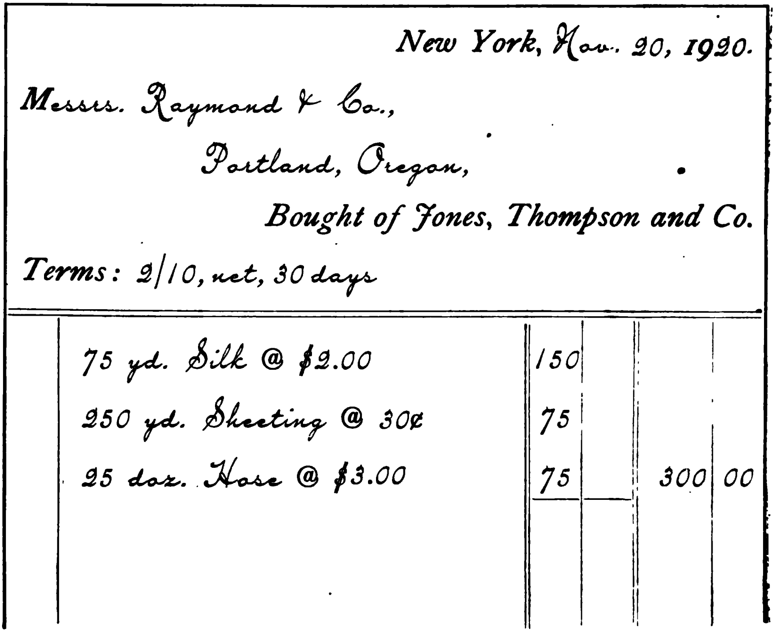
Feb.	17	2 ft. ½ in. Brass pipe	1	28		
"	"	1 Union		75		
"	"	½ lb. Solder		40		
"	"	Labor repairing pipe	2	25	4	68
		Paid				
		W. H. Sullivan				

A Bill for Labor and Material

Business houses commonly use bills with a printed heading similar to the one above. For business that is small or merely occasional, suitably ruled blanks may be purchased for the purpose.

An itemized statement of goods bought of a manufacturer or wholesale dealer is called an **invoice.**

An invoice gives the date and place of the sale, the names of the purchaser and the seller, the quantities and prices of the goods sold, and the terms of sale.



New York, Nov. 20, 1920.

Messrs. Raymond & Co.,
Portland, Oregon,

Bought of Jones, Thompson and Co.

Terms: 2/10, net, 30 days

75 yd. Silk @ $2.00	150			
250 yd. Sheeting @ 30¢	75			
25 doz. Hose @ $3.00	75		300	00

An Invoice

Many manufacturers and dealers allow a purchaser to deduct a stated percentage of the amount of the bill if it is paid within a specified time. In the invoice given above, if Raymond & Co. pay the bill within 10 days, they can deduct 2% of the total amount. If they pay the bill after 10 days, but within 30 days, they must pay the full amount of the invoice. After that time they may be charged interest on the amount of the bill. The statement in the invoice giving these facts is called the **terms of sale.**

[With pencil or pen.]

Supplying dates and addresses, make out and receipt these bills, using the form on page 142:

1. Mary Thomas has a picture framed by the New Era Art Company for $2.15.

2. John Barton sold Lawrence Lovell an 8-lb. turkey at 50¢ a pound.

3. J. A. Wing, a plumber, repaired a leak in Thomas Martin's house. The solder and washers used were billed at 90¢; the labor was billed at $3.55.

4. Mrs. T. R. Butler bought of W. G. Bush, the florist: 2 boxes of pansy plants at 40¢ a box; 1 doz. tomato plants at 40¢ a dozen; 4 ramblers at 25¢ each; 1 doz. dahlias at 75¢ a dozen.

5. Fred Scott worked for James Riley at 40¢ an hour: May 7, 6 hours; May 8, 9 hours; May 11, 7 hours; May 24, 5 hours.

Find the amount due:

6. Fisk and Co., booksellers, received an invoice of books amounting to $85.40. The terms were net, 30 days; 2% off for cash. They paid the bill immediately.

7. Samuel and Co., wholesale druggists, sold Paul Haynes 163 gal. crude sperm oil @ 88¢. Terms: net, 30 days; 3% off if paid within 10 days. The bill was paid immediately.

8. Ayling and Peters, wholesale grocers, sold M. J. Hogan: 4 bbl. sugar @ $25.85, 2 bbl. molasses @ $22.75, 1 cask of prunes @ $28.25. Terms: 60 days, net. The bill was paid at the end of one month.

9. H. L. Jameson bought of the East Side Seed Company: 2 bu. of clover seed @ $4.80, ½ bu. of garden corn @ $2.80, 3 bu. Timothy seed @ $3.25. Terms: 2/10, 30 days, net. He paid the bill within 10 days.

*10. The Louisville Lumber Company sold to John Closkey the following lot of yellow pine at $28 per M:

70 pieces 4 in. × 4 in. × 16 ft.
55 pieces 6 in. × 6 in. × 18 ft.
50 pieces 6 in. × 6 in. × 24 ft.

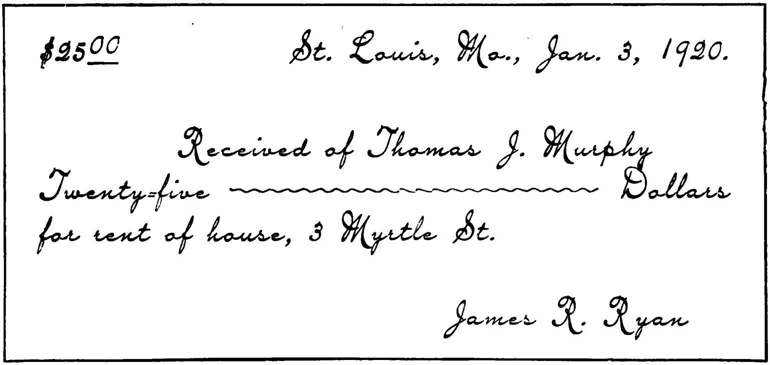
Terms: net, 30 days. The bill was paid within that time.

*11. Sawyer, Hayden and Co. bought of R. J. Mixner and Co.: 720 ft. flooring @ 47¢, 600 ft. studding @ 36¢, 3000 shingles @ $9.50 per M. Terms: 2/10, net, 30 days. The bill was paid on the ninth day.

5. Receipts

Most bills are receipted by writing or stamping on the bill, under the words "Received payment," the name of the person or firm receiving the money, and the date. Whenever a check is sent, its endorsement by the receiver is in itself a receipt and should be preserved.

It is sometimes convenient, however, to make out a separate receipt, as when a person pays his rent in cash.



$25 00 St. Louis, Mo., Jan. 3, 1920.

Received of Thomas J. Murphy
Twenty-five ~~~~~~~~~~ Dollars
for rent of house, 3 Myrtle St.

James R. Ryan

A Receipt

It is a wise rule never to pay any considerable sum of money without taking a receipt for it in some form.

Make out receipts: **[With pencil or pen.]**

1. George Soule paid Henry Kelly $37.84 for furniture.

2. L. R. Brown paid $55.75 to M. L. White, an insurance agent, for life insurance.

3. Mary Davee received $4.50 from Mrs. R. L. Chandler as weekly wages.

6. Accounts

I. KEEPING A CASH ACCOUNT

Dr.	Cash		
19........			
Oct. 1	On hand	9	50
5	Salary	18	00
		27	50
9	Balance forward	10	45

Simple forms for keeping personal accounts are given on pages 146, 147, and 148. The first form (pages 146 and 147) requires two opposite pages; the second (page 148), a single page only.

In the first form, instead of using the words "Received" and "Paid" in keeping the account, some such term as "Cash" is often used. Cash is **debited** with each sum of money received, and **credited** with each amount paid out.

The account may be balanced each week or at the close of each month. The word *Balance*, with the amount, is preferably written in red ink.

	Cash	Cr.	
19........			
Oct. 2	Pair of gloves	2	00
4	Ticket to concert		75
	Board and room	12	00
6	Laundry		75
7	Street car fares		20
8	Book	1	35
	Balance	10	45
		27	50
10	Newspaper subscription	3	50
11	Board and room	12	00

In the following form, for which a single page is used, the account is debited with each sum of money received, and credited with each sum of money paid out.

19........	Cash	Dr.		Cr.	
Oct. 1	Cash on hand	9	50		
2	Pair of gloves			2	00
4	Ticket to concert				75
	Board and room			12	00
5	Salary	18	00		
6	Laundry				75
7	Street car fares				20
8	Book			1	35
	Balance			10	45
		27	50	27	50
9	Balance forward	10	45		
10	Newspaper subscription			3	50
11	Board and room			6	00

1. Purchase a blank book ruled similarly to one of the forms just given, and keep your cash account. Let the teacher inspect it once a month to correct errors and to suggest improvements.

*2. With your parents' consent, keep an account of the household expenses.

7. Inventories

An **inventory** is a list of goods with their valuation.

[Use pencil when needed.]

1. Find the value of Mr. Alderman's farm, including equipment, stock, and crops, as listed in the inventory below:

Item	Value	Total
Plant:	$	$
Land, including improvements, etc., 300 acres, at $125 an acre	.....	.....
House furniture, etc.	.....	1000
Live stock —		
2 horses, at $125	.....	
2 colts, at $60	.....	
27 head stock cattle, at $80	.....	
8 cows and heifers, at $80	.....	
8 hogs, at $36	.....	.....
Machinery and tools —		
Farm wagon	80	
Buggy	80	
Harness, etc.	50	
Drill and plows	115	
Harrow	24	
Wheelbarrow	5	
Forks, etc.	10	.....
Materials and supplies:		
Feed and salable products on hand —		
Hay for stock, 30 tons, at $30	.....	
Grain for stock, 70 barrels corn, at $5	.....	.....
Growing wheat, 80 acres, at $80	.....	
Other growing crops	725	.....
Total	.....	.....

Merchants usually take an inventory of goods on hand at least once or twice a year. It is customary, also, to make an inventory before selling a business.

2. Why is it convenient in case of fire to have an inventory of all property upon which there is insurance? Why is this especially necessary in the case of household goods?

3. Why is it wise, in selling a farm, for the owner to take an inventory before making a price on the farm?

*4. Make an inventory of your personal possessions. Include books, games, pens, pencils, and other stationery; also any money you may have in the bank or elsewhere, and any other articles of value. Find the total estimated value.

*5. As a class exercise, with the aid of your teacher, make an inventory of all the property in your schoolroom belonging to the school. Estimate, as best you can, the present value of each article and the total value.

8. Contracts

Every one is frequently called upon to agree with other persons to do certain things. Most agreements are made orally, but important agreements are usually put into writing and signed by the persons concerned. If Mr. Jones writes a letter agreeing to do a certain thing for Mr. Smith for some consideration of value, and if Mr. Smith replies, accepting Mr. Jones's proposal, such an exchange of letters legally binds Mr. Jones and Mr. Smith to carry out the arrangement proposed.

It is often considered better, however, to put such an understanding, if important, into clear, brief written form, called a **contract**. The contract, when properly drawn, is made binding by the persons concerned signing their names to it. A person should never sign a paper unless he understands fully what it contains, for he may be compelled to carry out any agreement he thus enters into.

Contracts often follow the form of the one given below:

Contract between George Saunders and Frank L. Everett.

This agreement made this seventh day of April, A.D. 1920, between George Saunders of the town of Marietta, Ohio, and Frank L. Everett of the same place, witnesseth: That the said George Saunders agrees to act as superintendent of the farm of said Frank L. Everett in the town of Marietta, Ohio, during a period of two years, beginning May 1, 1920, and ending April 30, 1922.

In consideration of the services so performed, the said Frank L. Everett agrees to pay to the said George Saunders the sum of one hundred dollars ($100) per month, to be paid at the end of each month of said term.

In witness whereof, we have hereunto set our hands this seventh day of April, 1920.

Witnesses to signatures:

George Saunders
Frank L. Everett

Thomas A. Everett
Mabel L. Covey

[With pencil or pen.]

1. Draw up a contract with your father or mother to perform certain work about your home for a certain time.

*2. Draw up a contract with your teacher to assist in the care of the schoolroom or the school grounds for a period of one week.

9. Review

I. Progress Score

With the help of these tests measure your accuracy in computing. Try to make 100 points on each test, counting for each correct answer the score given below the letter of the problem.

If you fail to get the correct answer to a problem, use for practice the exercise of the same kind and letter on pages 304–313, then try the problem again.[1]

ADDITION TEST

Add:

[Copy problems only when necessary.]

A. (5)
7
8
6
9
8
7
9
8
9
7
8
7

B. (6)
576
375
429
854
357
645
859
745
378

C. (7)
6435
786
5457
475
3254
55478
3785
67958
3879

D. (5) $14\frac{7}{16}$ + $22\frac{5}{16}$

E. (6) $18\frac{7}{8}$ + $25\frac{3}{8}$

F. (5) $24\frac{7}{12}$ + $38\frac{1}{6}$

G. (7) $32\frac{3}{5}$ + $21\frac{4}{5}$

H. (6) $44\frac{2}{3}$ + $27\frac{1}{4}$

I. (8) $43\frac{5}{6}$ + $82\frac{5}{8}$

[Write answer without copying problem.]

J. $9.78 + $4.25 + $17.84 = ?
(6)

[Copy in column form and find answers.]

K. $241\frac{5}{6} + 183\frac{2}{5} + 734\frac{1}{10} = ?$
(8)

L. $413.72 + $1243.89 + $675.43 + $92.96 + $187.24 = ?
(6)

M. $7.42 + 64¢ + $8\frac{1}{4}$¢ + $5\frac{1}{2}$ mills + $17\frac{1}{2}$¢ + $2 = ?
(8)

N. 12.75 + 34.62 + 4.635 + 14.54 + 18.782 = ?
(6)

O. $9.71 + 8.64 + 9\frac{3}{4} + 8\frac{3}{10} + 7\frac{3}{8} + 2.04\frac{1}{2} = ?$
(11)

SUBTRACTION TEST

A. (5) 642974 − 38790

B. (6) 509010 − 328974

C. (6) $72\frac{7}{8} - 28\frac{5}{8}$

D. (7) $32 - 16\frac{3}{4}$

E. (8) $26\frac{1}{3} - 14\frac{2}{3}$

F. (6) $36\frac{2}{3} - 18\frac{1}{15}$

G. (9) $54\frac{1}{2} - 18\frac{5}{8}$

H. (7) $42\frac{8}{9} - 27\frac{5}{6}$

I. (9) $723\frac{2}{5} - 344\frac{2}{3}$

J. (5) $300.00 − 128.96

---

[1] For measuring pupils' progress, see footnote, page 37.

K. $\$5 - 14\frac{3}{4}¢ = ?$ (8) L. $8.375 - 1.28 = ?$ (6) M. $42.75 - 8.642 = ?$ (7)

N. $24.72 - 6.1\frac{3}{8} = ?$ (11)

Multiplication Test

A. $\begin{array}{r}5960\\ \underline{\quad 8}\end{array}$ (5) B. $\begin{array}{r}3768\\ \underline{\quad 79}\end{array}$ (6) C. $\begin{array}{r}6750\\ \underline{4060}\end{array}$ (6) D. $\frac{2}{3} \times 120 = ?$ (3) E. $52 \times \frac{3}{5} = ?$ (7)

F. $\begin{array}{r}45\frac{2}{3}\\ \underline{8}\end{array}$ (9) G. $\begin{array}{r}27\\ \underline{3\frac{3}{4}}\end{array}$ (11) H. $\begin{array}{r}176\\ \underline{14\frac{3}{8}}\end{array}$ (12) I. $\frac{3}{4} \times 1\frac{1}{2} = ?$ (5) J. $3\frac{3}{7} \times 2\frac{5}{6} = ?$ (8)

K. $\begin{array}{r}\$3.69\\ \underline{24.8}\end{array}$ (8) L. $\begin{array}{r}.032\\ \underline{.27}\end{array}$ (8) M. $5.14 \times .03\frac{1}{4} = ?$ (12)

Division Test

A. $8\overline{)58878}$ (4) B. $62\overline{)562340}$ (5) C. $77\overline{)65358}$ (6) D. $144\overline{)99792}$ (9)

E. $12 \div \frac{5}{6} = ?$ (5) F. $\frac{7}{8} \div \frac{3}{4} = ?$ (5) G. $\frac{4}{5} \div 3 = ?$ (5) H. $14\frac{2}{7} \div 3 = ?$ (6)

I. $24\frac{1}{2} \div 2\frac{1}{3} = ?$ (7) J. $25\overline{)57.78}$ (8) K. $3.2\overline{).2304}$ (7) L. $1.14\overline{)71.82}$ (6)

M. $.125\overline{)225}$ (8) N. $6000\overline{)\$875}$ (8) O. $\dfrac{64\frac{3}{5} - (4.1 + 6\frac{1}{2})}{2.25} = ?$ (11)

II. Problem Review

[Without pencil.

1. Why is it important that one should pay all bills promptly?

2. A clerk's total sales for Monday were $118.40 and for Tuesday, $143.80. How much more did his sales amount to on Tuesday?

3. Mrs. Ames ordered the following groceries: a 5-lb. fowl at 35¢, 2 loaves of bread at 10¢, 2 pecks of potatoes at 45¢. What was the total amount charged on the salesman's slip?

4. My monthly statement from Marshall Field showed charges amounting to $24.30 and a credit of $1.29. For how much must I draw my check to settle the bill?

5. Mrs. Thorne employed a dressmaker 3 days at $3.00 a day and carfare, which amounted to 12¢ a day. What was the total amount of the bill?

6. How much must I pay to settle a bill for $50 when 2% off for cash is allowed and the bill is paid immediately?

7. George Martin received an invoice of 80 bushels of potatoes at $1.50 a bushel. The terms of sale were 5/10, net, 30 days. How much discount did he receive if he paid the bill on the third day after receiving it?

8. A girl received during the month of March, $2 for helping at home and 50¢ as a birthday gift. She paid $1.85 for various items during the month. If she had $3.50 on hand March 1, what was the amount of her balance March 31?

9. What balance will I carry forward to the next month's account if my total receipts for a month are $18.50 and my total expenditures are $7.19?

10. James Ryan contracted to work for Marcus Somers for 2 years at a salary of $900 a year. How much did he receive a month?

[With pencil.]

11. A clerk made the following sale to a customer: 2 pecks potatoes @ 50¢; 20 lb. sugar @ 12¢; 3 doz. eggs @ 60¢; 5 gal. kerosene @ 20¢; 2 lb. butter @ 65¢; 3 cans corn @ 17¢. What was the total amount to be entered on the sales slip?

12. I bought, Sept. 15, 1 coat at $32.50, 12 yd. of silkalene at 30¢, 2 doz. buttons at 35¢ a dozen, ½ doz. handkerchiefs at $3.00 a dozen; on Sept. 27, 4 yd. silk at $1.75 a yard, 10 yd. ribbon at 35¢ a yard. Sept. 28, I returned and received credit for 1 doz. buttons at 35¢ a dozen, and 3 yd. ribbon at 35¢ a yard. Find the amount left from a fifty-dollar bill in paying the balance due.

13. Horace Bentley engaged A. J. Manny and team at $6.75 a day for 17½ days. Make out and receipt the bill.

14. The Henry Wilkinson Hardware Company sold to Patchet and Co.: 2 doz. wheelbarrows @ $24.50 a dozen; 1½ doz. 8-foot stepladders @ $25 a dozen; 3 doz. hoes @ $5.75 a dozen. 5% off for cash was allowed. If the bill was paid at once, how much did the goods cost Patchet and Co.?

15. Make out a receipt for the payment to George Buckley by Mrs. Sarah Owen, of $25 for house rent during the month of October, 1920.

16. Harvey Smith's bill for the painting of his house contained the following items: 4 days' labor of 3 men at $6.00 a day each; paint and other materials, $96. Find the amount of the bill.

17. Find the balance to carry forward to the next month's account when the amount brought forward from the preceding month is $14.23, and the receipts for the month are: $48, $2.50, $.94; and the expenditures are: $5, $.75, $.12, $8.25, $2.60, $.60, $1.75, $6.19, $.43, $2, $.89, $7.20.

18. Clarence Tower had an average income last year of $79⅛ a month. His average monthly expenses were $60.50. If he started the year with a balance on hand of $632.80, what was his balance at the end of the year?

19. Using the form given on page 151, draw up a contract between James Morehouse and Augustus Byrnes, in which the former agrees to work for the latter for six months, at $50 a month. Select your own dates, name of town, and names of witnesses.

CHAPTER III. METHODS OF SENDING MONEY

10. Registered Mail and Express

Money may be sent by **registered mail** or by **express.**

The fee for registering a letter or a package is 10¢ in addition to the regular postage. The post-office authorities take every precaution against the loss of registered mail, but assume no risk beyond the value of $50 for first-class mail and $25 for third- and fourth-class matter. The registered package may be insured by an insurance company, and thus be fully protected. When requested, a receipted card showing the date and time of the delivery of the registered package is returned to the sender. The name and address of the sender must be plainly written on the outside of a registered package.

Large sums of money, particularly gold, are shipped by express. This method is entirely safe, as the express companies guarantee the safe delivery of the shipment. It is, however, an expensive method of sending money.

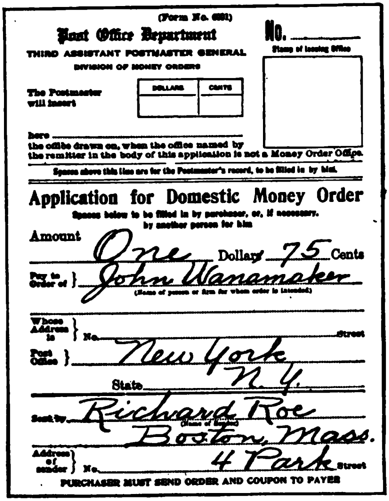
11. Postal Money Orders and Express Orders

A cheap, convenient, and safe method of sending money is by **postal money order.**

If, for example, you wished to send to John Wanamaker in New York for a tennis racket that costs $1.75, you would fill out at your post office an application blank, like the one shown on page 157, giving the clerk $1.75 plus a small fee — in this case, 3¢. The clerk would fill out an order on the New York post office. You would send this order (also shown on the opposite page) in a letter to the store of John Wanamaker in New York. Upon its receipt, the store would cash it at the New York post-office or deposit it at a bank.

POSTAL MONEY ORDER RATES

Not over $2.50	3¢
From $2.51 to $5.00	5¢
“ $5.01 to $10.00	8¢
“ $10.01 to $20.00	10¢
“ $20.01 to $30.00	12¢
“ $30.01 to $40.00	15¢
“ $40.01 to $50.00	18¢
“ $50.01 to $60.00	20¢
“ $60.01 to $75.00	25¢
“ $75.01 to $100.00	30¢



Post Office Department

THIRD ASSISTANT POSTMASTER GENERAL

DIVISION OF MONEY ORDERS

No. ____

Stamp of Issuing Office

The Postmaster will insert

DOLLARS	CENTS

here ____

the office drawn on, when the office named by the remitter in the body of this application is not a Money Order Office.

Spaces above this line are for the Postmaster's record, to be filled in by him.

Application for Domestic Money Order

Spaces below to be filled in by purchaser, or, if necessary, by another person for him

Amount One Dollars 75 Cents

Pay to Order of } John Wanamaker

(Name of person or firm for whom order is intended)

Whose Address is } No. ____ Street

Post Office } New York

State N. Y.

Sent by Richard Roe

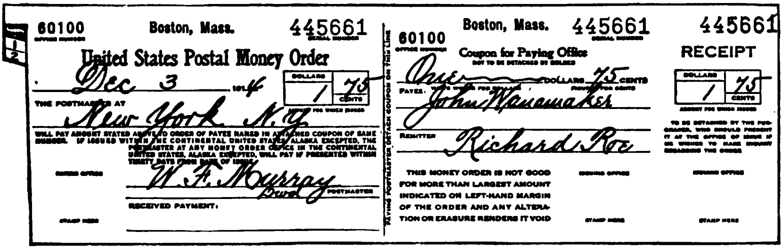
Boston, Mass.

Address of sender } No. 4 Park Street

PURCHASER MUST SEND ORDER AND COUPON TO PAYEE

Application for Postal Money Order

The cost of sending amounts over $100 is found by using the rates given above.



60100 Boston, Mass. 445661

United States Postal Money Order

Dec 3 1914

DOLLARS	
1	75
	CENTS

THE POSTMASTER AT New York N.Y.

WILL PAY AMOUNT STATED ABOVE TO ORDER OF PAYEE NAMED IN ATTACHED COUPON OF SAME NUMBER. IF ISSUED WITHIN THE CONTINENTAL UNITED STATES, ALASKA EXCEPTED, THE POSTMASTER AT ANY MONEY ORDER OFFICE IN THE CONTINENTAL UNITED STATES, ALASKA EXCEPTED, WILL PAY IF PRESENTED WITHIN THIRTY DAYS FROM DATE OF ISSUE.

W. F. Murray POSTMASTER

Burd

RECEIVED PAYMENT:

STAMP HERE

60100 Boston, Mass. 445661

Coupon for Paying Office

NOT TO BE DETACHED BY HOLDER

One DOLLARS 75 CENTS

PAYEE. John Wanamaker

REMITTER Richard Roe

THIS MONEY ORDER IS NOT GOOD FOR MORE THAN LARGEST AMOUNT INDICATED ON LEFT-HAND MARGIN OF THE ORDER AND ANY ALTERATION OR ERASURE RENDERS IT VOID

PAYING POSTMASTER DETACH COUPON ON THIS LINE

STAMP HERE

445661

RECEIPT

DOLLARS	
1	75
	CENTS

TO BE DETACHED BY THE PURCHASER, WHO SHOULD PRESENT IT AT THE OFFICE OF ISSUE IF HE WISHES TO MAKE INQUIRY REGARDING THE ORDER

STAMP HERE

Postal Money Order

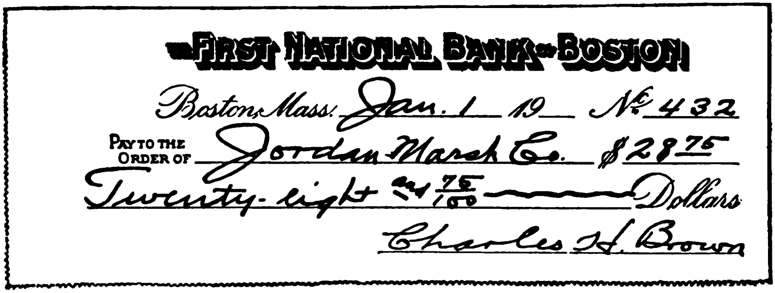
Orders similar to postal orders, called **express orders**, may be obtained from express companies and mailed as desired. These may be cashed at any office of the express company. Banks will also accept them from depositors. An express order costs about the same as a postal order for the same amount.

12. Bank Checks and Drafts

I. The Check

The most common method of transmitting money is by **bank check**. This method is so safe and convenient that over 90% of the total indebtedness of the country is canceled by the use of checks.

Mr. Charles H. Brown has money on deposit in the First National Bank of Boston and owes the Jordan Marsh Company of Boston $28.75. To pay this bill, Mr. Brown makes out the following check and mails it to the Jordan Marsh Company:



FIRST NATIONAL BANK OF BOSTON

Boston, Mass. Jan. 1 19__ No. 432

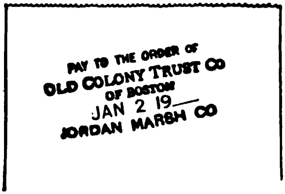
Pay to the Order of Jordan Marsh Co. $28 75/100

Twenty-eight and 75/100 Dollars

Charles H. Brown

A Personal Check

Jordan Marsh Company indorses the check by writing, or stamping, the name of the company across the back.



PAY TO THE ORDER OF
OLD COLONY TRUST CO
OF BOSTON
JAN 2 19
JORDAN MARSH CO

Stamped Indorsement

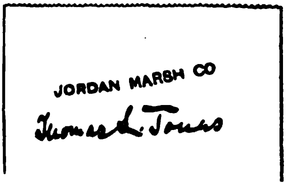
The check is deposited at the Old Colony Trust Company, and the amount is credited to the account of Jordan Marsh Company. It then goes to the First National Bank through the Boston Clearing House, is charged against the account of Charles H. Brown, and returned, canceled, at the end of the month to Mr. Brown, with his other canceled checks.

If the check had been indorsed only with the name of the payee, it would have been payable to any other person who indorsed it.

If Thomas L. Jones, for example, had received the check, he would have indorsed it below Jordan Marsh Company's indorsement, as shown in the illustration.

He could then have cashed it at any bank where he was known or could be identified.

Banks sometimes charge a small fee for cashing a check drawn on a bank in another city.



JORDAN MARSH CO

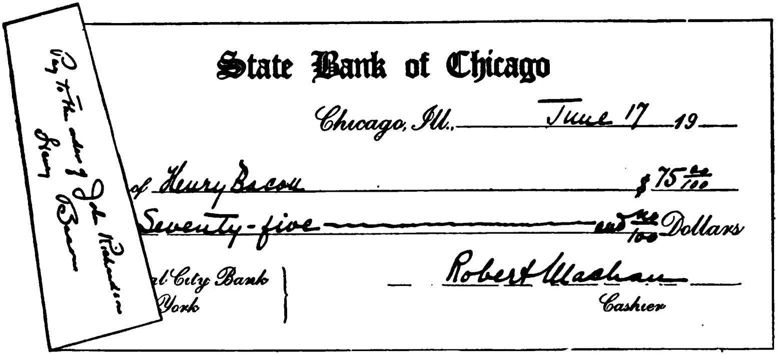
Thomas L. Jones

Two Indorsements

II. The Draft

For sending money to a distant place, a **bank draft** is often used. A bank draft is merely a check drawn by a bank and signed by its cashier. When a draft is issued to be paid by a New York bank, it is called a "draft on New York"; when it is to be paid by a Chicago bank, it is called a "draft on Chicago."

Nearly all banks throughout the country keep a deposit in some New York bank so that they can sell drafts on New York. For example, Henry Bacon, of Chicago, might send $75 to John Richardson, of Charleston, by the following draft:



Pay to the order of John Richardson
Henry Bacon

State Bank of Chicago

Chicago, Ill., June 17 19

of Henry Bacon $75 00/100

Seventy-five and 00/100 Dollars

l City Bank
York

Robert Maclean
Cashier

A Bank Draft

This draft is obtained by Henry Bacon from the State Bank of Chicago on a payment of $75 to the bank. Henry Bacon indorses the draft by writing across the back: "Pay to the order of John Richardson. Henry Bacon." He then mails it to John Richardson, who, after indorsing it, cashes it at some bank in Charleston where he is known. That bank sends it for collection from the National City Bank of New York, where it is payable, through the Federal Reserve banks of Charleston and New York.

If Henry Bacon had preferred, he could have had the bank substitute the name of John Richardson on the face of the draft in place of his own name, in which case he would not have indorsed the draft.

In indorsing it, Henry Bacon was careful to write: "Pay to the order of John Richardson." What reason did he have for indorsing in that form rather than by writing only his name?

13. Telegram and Cable

In emergencies, money is sometimes sent to other places in this country by **telegram**, and to foreign countries by **cable**. These are the quickest but also the most expensive ways of sending money.

The charge for telegraphing money in this country is found by adding to the usual charge for a fifteen-word message, a fee:

For $25 or less	25¢
25.01 up to $50	35¢
50.01 " " 75	60¢
75.01 " " 100	85¢[1]

The amount to be sent, with charges, is paid to the agent of the telegraph or cable company.

14. Problems on Sending Money

[Use pencil only when needed.]

1. Bring to class blanks to be filled out (*a*) in registering letters, (*b*) in sending postal money orders. Bring also (*c*) blank

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[1] For larger amounts, fees somewhat less proportionately are charged.

checks, and (*d*) drafts.[1] Learn how to use each of these forms in sending money.

2. How much more will it cost to send $25 by express, with a charge of 35¢, than by registered mail, including 2¢ for postage?

3. How much less would it cost to purchase and mail a bank draft for $25, the banker's fee for which is 10¢, than to send this amount by express with a charge of 35¢?

4. Using the money order rates given on page 157, find the cost of sending a money order for $25, including postage. For $2.75; $5.10; $18; $11.50; $72.

5. A postal money order is to be purchased to cover the cost of 36 books at 85¢ each. What sum of money is required?

6. Make and solve five other problems about sending money by means of postal money orders. Include 2 cents postage in each case.

7. Mr. Haywood paid $1.65 to telegraph $100 from Kansas City, Mo., to his son in Boston. It cost the son $.60 to telegraph that he needed the money. What per cent of the $100 did it cost to send the money, including the messages both ways?

8. At the request of Mr. Holmes, a bank in New York cabled $200 to Mrs. Holmes, who was traveling in Europe. If the cost of the cable was $2 and the bank's fee was 1½% of the sum sent, how much did it cost to send the money?

9. A young woman while traveling had her pocket book stolen. She telegraphed home for $50. Her father paid 35¢ due on her telegram and telegraphed her the sum requested. He paid 45¢ for his message and 35¢ for the transfer of the money. How much did the father have to pay the telegraph company?

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[1] Pupils can usually obtain these blanks at the local post office and banks, if their proposed use is carefully explained. Let one pupil, or a committee, be selected to go to each place from which blanks are desired. These visits may be made a valuable part of the pupil's business training.

10. With the help of the printed form on page 158, make a blank check on the Eighth-Grade Bank. Fill out the check, payable to some local grocer or other business man, for a bill amounting to $19.74.

11. A bill for 11 football suits at $7.75 each and 4 sweaters at $7.50 each is to be paid to A. G. Spaulding and Company, New York. Robert Payne buys a draft from C. A. Kidder, Cashier of the Second National Bank of Cleveland, Ohio, payable at the National City Bank of New York. Write the required draft, following the form on page 159.

12. R. J. Tiffany has an account with the Third National Bank of St. Louis and wishes to pay a bill of $18.50 to L. S. Stearns and Co. of Louisville, Ky. Write the check he would send. If L. S. Stearns and Co. wishes to deposit the check to their account at the Louisville Trust Company, show how they would indorse the check.

13. Write the bank draft that R. J. Tiffany, in problem 12, might have purchased from J. A. Jones, Cashier of the Third National Bank of St. Louis, to send L. S. Stearns and Co. in payment of his bill, instead of paying it by check. Make it payable at the Kentucky National Bank, Louisville.

14. Cut three slips of paper the size of a bank check. Imagine these to be checks payable to you. Indorse one with your name only. Indorse one so that it can only be deposited to your account at some bank. Indorse the third one so that it will be payable to John R. Smith. Compare these indorsements with those on canceled checks that you may borrow from your father or some business man.

*15. A real estate agent sells a house for $3000. He forwards to the former owner a bank draft for this amount less his commission of $1\frac{1}{2}\%$ and the cost of the draft, $7.50. What was the amount of the draft?

15. Sending Money to Foreign Countries

I

Money may be sent to a foreign country by **cable**; by an **international money order**; by a **foreign express order**; or by a bank draft called a **foreign bill of exchange**.

Sending money by cable is the most expensive method, but often saves valuable time. An international money order may be purchased at any of the large post offices and is payable at the post office named in the order. A foreign express order, like other express orders, may be cashed in almost any foreign city where the person to whom it is sent can be identified. A foreign bill of exchange is also easily cashed at a bank, upon identification.

On all the three forms named above, the money is expressed in the currency of the country to which it is to be sent. For example, if $10 is to go to London, it would appear in the order as £2 1s. (see table below), or approximately that amount. The amount varies from time to time according to the **rate of exchange**, or the value in one country of the money of another country.

STANDARD EQUIVALENTS FOR FOREIGN COINS

British pound sterling (£)	$4.8665	Italian lira	$0.193
British shilling (s.)	$0.243	Russian ruble	$0.515
German mark (M.)	$0.238	Spanish peseta	$0.193
French franc (fr.)	$0.193	Mexican peso	$0.498

[With pencil.]

Using the table above, express in dollars and cents:

1. £2	3. 20 M.	5. 100 lire[1]	7. 25 pesetas
2. 3s.	4. 15 fr.	6. 7½ rubles	8. 34 pesos

9. Make and solve other problems based upon the table above, or upon the table at the end of the book.

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[1] *Lire* is the plural of *lira*.

[Without pencil.]

10. Which of the coins in the table on page 163 are approximately equivalent to 20¢? To 25¢?

For ordinary quick figuring, we think of an English pound as equivalent to $5.00; of a shilling as 25¢; of a mark as 25¢; of a franc, a lira, or a peseta, as 20¢; of a peso or a ruble, as 50¢. Using these equivalents, give the approximate value of:

11. $25.00 in British money.

12. $1.50 in British money.

13. $2.75 in German money

14. 40¢ in French money.

15. $3.20 in Italian money.

16. $400 in Mexican money.

17. $100 in British, French, German, Mexican, and Italian money.

18. Make and solve ten other problems based on these approximate equivalents.

II

In forwarding money to foreign countries, current rates of exchange are consulted. These are published in newspapers in large cities.

The variation in the rates of exchange is due to the relative demand for money in the different countries. If there is plenty of money to carry on the business of the country, money in that country will be cheap, and its rate of exchange "at par" or "below par"; if more money is needed than is at the time available, money will be "high," and its rate of exchange "above par."

English exchange is quoted as dollars to the pound sterling. £100 @ 4.87 means that £1 is worth $4.87, and £100 is equivalent to $487.00.

French exchange is quoted as the number of francs that can be purchased for $1. Thus $5.14\frac{3}{8}$ shows that $5.14\frac{3}{8}$ francs will cost $1.

German exchange is quoted as the number of cents that 4 marks will cost. Thus, $95\frac{1}{2}$ shows that 4 marks will cost $95\frac{1}{2}$¢.

[With pencil.]

Find the value in United States money of:

1. £25 @ 4.85.
2. £16 @ 4.89.
3. £3 6s[1] @ 4.88.
4. £2 10s @ 4.86.
5. £5 15s @ 4.87.
6. £1 18s @ 4.86.
7. 20 M. @ $95\frac{1}{2}$
8. 12 M. @ 96.
9. 50 M. @ $95\frac{3}{4}$.
10. 100 M. @ $95\frac{1}{8}$.
11. 2500 M. @ $94\frac{7}{8}$.
12. 72 fr. @ 5.15.
13. 439 fr. @ $5.14\frac{1}{2}$.
14. 24,700 fr. @ $5.14\frac{7}{8}$.

15. Jean Hugo sent from St. Louis to his father in Paris a bank draft for 75 fr. With exchange at 5.44, how much did it cost?

16. Mr. Tyler sent to London for a book that was listed at £2. How much did he pay for the express order with exchange at 4.20 and the fee for the order, 5¢?

17. Bernard Reimich sent his sister in Germany an express order for 120 M. With exchange at 136, how much did the express order cost him, including a fee of 12¢?

18. Domenico sent to his family in Florence, Italy, for Christmas, a money order for $9.70. If the lira was worth 19.4¢, how many lire did the family receive when they cashed the money order?

***19.** How much is $25 worth in British money with exchange at 4.85? In French money, at 5.15? In German money, at $95\frac{1}{2}$?

***20.** Since the great European war, our exchange rates with European countries have been abnormally low. Consult newspapers for current rates of exchange and find the present value in United States money of the pound sterling. Of the franc. Of the lira.

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[1] There are 20 shillings in a pound sterling. Hence, 6s = £$\frac{6}{20}$, and £3 6s = £$3\frac{6}{20}$ or £$3\frac{3}{10}$.

CHAPTER IV. SAVING AND INVESTING MONEY

16. Saving Money

ACTUAL LIFE EXPERIENCES OF 100 MEN[1]

At age 22	At age 35	At age 45
100 men, all strong and vigorous, with good mental and physical capacity.	5 have died; 20 are in good circumstances; 40 have moderate means; 35 are self-supporting, but have saved nothing.	16 have died; 3 are in good circumstances; 65 are self-supporting, but have saved nothing; 16 are no longer self-supporting.
At age 55	**At age 65**	**At age 75**
20 have died; 4 are in good circumstances; 46 are self-supporting, but without means; 30 are dependent on children, relatives, or charity for support.	36 have died; 4 are in good circumstances; 6 are self-supporting; 54 are dependent on children, relatives, or charity for support.	63 have died; 3 are in good circumstances; 34 are dependent upon children, relatives, or charity for support.

[Use pencil only when needed.]

1. In the above table what per cent of the 100 men were in good or moderate circumstances or self-supporting at 35 years of age? At 45? At 55? At 65? At 75?

2. At 45 years of age, what per cent of those living were in good circumstances or self-supporting? At 55 years? At 65?

3. Make and solve three other problems based on the table.

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[1] Compiled by the American Banker's Association.

The following table shows the results from systematic savings deposited each month in a Savings Bank that adds interest at 4% every 6 months.

Monthly savings	6 years	7 years	8 years	9 years	10 years
$1................	$81.32	$96.87	$113.04	$129.83	$147.35
$2................	162.65	193.74	226.09	259.67	294.70
$3................	243.97	290.61	339.13	389.50	442.05
$5................	406.62	484.35	565.22	649.17	736.74
$10...............	813.25	968.89	1,130.45	1,298.35	1,473.48

Fill the blanks: [Without pencil.]

4. A boy deposited $2 a month. In 6 years he had in the bank $—.

5. A girl deposited $3 a month for 10 years. She then had $—.

6. Make two other similar statements.

17. Good and Bad Investments[1]

I. "Safety First" in Investments

Every person should not only try to save some of his earnings, but also learn how to invest his savings wisely. Millions of hard-earned dollars are lost each year through foolish investments. The newspapers and mails bring to our attention numerous offers of investment. Some of them are honest and reliable, but many either are frauds or are too unsafe to be considered by the wise investor. "Safety first" should apply to all investments. Usually, the higher the rate of income offered by an investment, the greater is the risk of losing the money invested.

II. Safety of Banks

[With pencil.]

1. In a recent year, out of a total of 25,000 banks in the United States, 79 failed. What per cent failed?

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[1] For a review of interest, see pages 85–96.

2. In the same year there were 15,500 business failures in the United States. The bank failures were what per cent of the total number of business failures?

3. Mr. Thomas put his savings of $18,000 in banks, where he received 4% interest, drawing the interest as it came due. How much interest did he receive in 10 years?

4. Mr. Thomas's brother invested an equal amount, $18,000, in a business that produced 8% income for 10 years and then failed. How much money did he lose?

*5. Mr. Brown's investments, which cost him, 5 years ago, $9,690, are to-day worth $5,475. He has received an income of $450 a year from these investments. If he had put the money 5 years ago into banks that paid 4% interest, and had drawn the interest as it came due, how much more money, including the income from these investments, would he have had?

18. Savings Banks

I. WHERE SAVINGS ACCOUNTS MAY BE KEPT

Savings Banks are established to provide a safe and convenient form of investment, especially for those who have only small sums of money to invest. Trust companies and other banking institutions have savings departments, and the United States government maintains postal savings banks at the larger post offices.

II. POSTAL SAVINGS BANKS

In all towns or cities where the post office has a savings department, an account may be opened by any person of the age of 10 years or over. The person who has money to deposit goes to the post office and asks to open an account. He gives his name and address and any other information that the postmaster requires by which to identify him at a later time.

For any number of dollars deposited, one or more certificates are given which enable the depositor later to withdraw his money if he desires to do so. Duplicates of the certificates are kept by the postmaster. The amounts covered by the certificates are: $1, $2, $5, $10, $20, $50, $100, $200 and $500.

Amounts less than $1 may be saved for deposit by purchasing a 10-cent postal savings card and 10-cent postal savings stamps. Each postal savings card bears blank spaces in which the stamps may be affixed from time to time. A postal savings card with nine postal savings stamps affixed may be exchanged at any time for a dollar certificate.

Interest at the rate of 2 per cent per annum is allowed on the value of each certificate, payable annually, beginning with the first day of the month next following that in which the deposit is made. Interest is not paid for any fraction of a year, and compound interest is not allowed.

A depositor may at any time withdraw the whole or any part of the deposits to his credit, with any interest payable thereon, by indorsing certificates for the amount that he wishes to withdraw.

A depositor may exchange postal savings certificates amounting to $20, or any multiple of $20 up to $500, for United States bonds bearing interest at $2\frac{1}{2}\%$ a year.

[Without pencil.]

1. A girl, with her savings, filled a postal savings card each month. What certificates of deposit could she purchase with her savings during a year?

2. At the end of the second year, this girl had certificates of deposit to the amount of $24. What interest did she receive on this amount during the following year?

3. How long would it require for a postal savings deposit of $10 to earn sufficient interest to purchase a $1 certificate?

4. What interest would be earned by three $100 certificates in 10 years?

5. What interest would be derived in 10 years from $200 in United States postal savings bonds, paying 2½%, not including the interest on this income?

[With pencil.]

6. Having opened an account in a postals savings bank, George made deposits in one year as follows: Dec. 31, $8; Jan. 28, $2; Feb. 8, $5; Apr. 3, $10; July 17, $3; Aug. 31, $12; Oct. 5, $6. How much money, including interest, did he have to his credit the following January? (See third paragraph, page 169.)

7. A boy has accumulated enough certificates of deposit to purchase United States bonds to the amount of $200. How much interest would he receive from these bonds in 25 years?

8. A man has $500. How much more interest would he receive in 5 years by purchasing with the money United States bonds paying 2½% interest, than by purchasing certificates of deposit in a postal savings bank?

9. Beginning Jan. 1, a woman saved out of her earnings $10 a month, and invested these savings in postal savings bonds. Not including interest, how much money would she have in her postal savings account at the end of 3 years?

*10. Make and solve an original problem on the use of the postal savings banks.

III. COMPOUND INTEREST[1]

The rate of interest paid by savings banks and trust companies varies from 3% to 5%. Usually, quarterly or semi-annually dates for the payment of interest are set. On these dates all interest due, if not withdrawn, is credited to the principal and from that time draws interest also. When this is done, money is said to be drawing **compound interest,** and the interest is said to be **compounded** quarterly or semi-annually, as the case may be.

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[1] For Compound Interest table and method of using it, see page 91.

May 1, 1920, I deposit $100 with a savings bank that pays 4% interest, compounded semi-annually. What amount is due me Nov. 1, 1921?

From May 1, 1920, to Nov. 1, 1921, = 1½ yr.

4% annual interest = 2% semi-annual interest.

100	principal.
.02	
2.00	interest for first 6 mo.
100.	
102.	am't due Nov. 1, 1920.
.02	
2.04	interest for second 6 mo.
102.	
104.04	am't due May 1, 1921.
.02	
2.08.	interest for third 6 mo.
104.04	
106.12	am't due Nov. 1, 1921.

In computing compound interest, banks, as a rule, disregard any sum that is less than a dollar. Thus, in the problem above, the interest for the third 6-months is based on $104, instead of $104.04. This rule should be followed in solving problems in compound interest.

[Without pencil.]

1. When a savings bank pays 4% interest compounded semi-annually, how much interest will be added to $100 that has been on deposit for 6 months?

Find the interest that would be credited on the first interest-paying date in each of the following cases:

	Am't on Deposit during the Interest Period	Annual Rate	Compounded
2.	$200	4%	semi-annually
3.	$50	4%	quarterly
4.	$300	3%	semi-annually
5.	$1000	4½%	semi-annually

6. $100 is deposited July 1, 1920, at 3% interest, compounded semi-annually, Jan. 1 and July 1. Find the total amount to the credit of the depositor Jan. 1, 1921.

7. Robert Adams opened an account with a savings bank that paid 4% interest by depositing $50, July 1, 1920. The bank compounded semi-annually, Jan. 1 and July 1. What principal was drawing interest Jan. 2, 1921?

8. April 1, $1000 was deposited in a Trust Company that paid 4% interest, compounded quarterly, interest beginning at once. Find the interest on July 1, the next interest date.

9. July 1, Robert Smith deposited $200 in a savings bank paying 4% interest, compounded semi-annually. He withdrew $100 Dec. 1, thus losing the interest on this amount from July 1. How much more interest would he have received if he had not withdrawn the $100 until Jan. 1?

10. Jan. 1, 1920, Jane Crowley deposited $25 in the Home Savings Bank. The bank paid 4% interest, compounded quarterly, beginning Jan. 1. Give the dates when interest was credited to her account. How much interest was credited to her, July 1, 1920?

[With pencil.]

11. A sum of $540 deposited in a savings bank on July 16, 1920, began to draw interest Nov. 1. Semi-annual interest of 2% is declared Nov. 1 and May 1. What was the principal drawing interest beginning May 1, 1921?

12. One hundred dollars drawing 3% interest, compounded annually, amounts to how much in 5 years?

13. A sum of $350 deposited in a trust company on March 3, 1919, began to draw interest April 1. Interest dates were Jan. 1 and July 1. Rate of interest was 5% per year. How much interest had the sum deposited earned by Jan. 1, 1920?

14. Arthur M. Smith made the following deposits in a bank paying 2% semi-annual interest Jan. 1 and July 1: Jan. 1, 1919, $90;

July 1, 1920, $85. He withdrew his money Jan. 1, 1921. How much money did he receive?

*15. Mary Browning made the following deposits in a trust company, which pays 4% interest, compounded Nov. 1 and May 1, and which begins to pay interest on deposits the first of the month following the making of the deposit: Apr. 10, 1919, $50; June 15, 1919, $75; Oct. 12, 1919, $68; Dec. 31, 1919, $286. If she withdrew all her money Mar. 20, 1920, how much did she receive? How much more might she have withdrawn had she left it until May 1, 1920?

19. Real Estate

One of the most common forms of investment is buying real estate, that is, land and houses. Real estate makes a desirable investment because of its safety, the tendency of wisely selected property to increase in value, and the possibility of saving rent by using the property as a home. The disadvantages of this form of investment are: the expense of maintaining the property — insurance, taxes, repairs; the liability to depreciation in value; and the difficulty of selling readily at full value.

[Use pencil when needed.]

1. Give some conditions under which property will depreciate in value. Give other conditions under which it is likely to increase in value.

2. A piece of property is offered for sale in the neighborhood of a public school, a city park, and a church. What advantages would such property have ? What disadvantages?

3. Why is a corner lot desirable? Why undesirable?

4. Is a lot in a factory neighborhood a good investment?

5. Explain why one should not put money into land at a great distance without having seen it.

6. What things determine the value of farm land? Of wood land?

7. For how much must property valued at $6000 be rented per month to bring in 10% annually?

8. A lot cost $300; the house on it, $2700. If the property sells for $4000, what per cent is gained on the money invested?

9. A lot cost $500. The house on it cost $2500. For how much must it be rented per year to make 5% on the investment, allowing $90 a year for taxes, repairs, and depreciation?

10. How much should I pay for a house that rents for $20 a month, in order to have it bring 12% on the money invested?

11. How much should I offer for a piece of property that rents for $30 a month, on which expenses amount to $120 a year, if I wish my money to earn 6%?

12. A man gained $1200 in selling a farm for $4800. What was his per cent of gain on the investment?

13. A farm was bought for $7500 and sold for $9000. What was the per cent of gain on the cost of the farm?

14. A farm bought for $2400 was sold for $3900, after $600 had been spent in making improvements. Find the per cent of gain on the money invested, including the cost of improvements.

15. A double house cost $6000. What must be the monthly rent per side to bring in 12% on the investment?

16. What is the per cent of gain on the cost of land bought for $1200 and sold for $1800?

17. The house that is rented by the Brown family is for sale for $5000. The family wish to know whether or not it will pay them to purchase it. To pay for the house, they will have to use savings amounting to $3000 invested at 4% and will also have to borrow $2000 at 5%. The purchase of the house means an annual cost of how much in interest to the family, including the loss of interest on savings?

18. If the Brown family buy the house (problem 17), each year they must pay $65 for taxes and $7.50 for insurance and must allow $80 for depreciation and repairs. Including the interest, this makes a total cost of how much a year?

19. The family are at present paying $40 a month rent. Will they increase or decrease their monthly expenses by buying the house? The difference amounts to how much a year? (See problems 17 and 18.)

20. A family, who had been paying rent of $22.50 a month, borrowed money at 6% to purchase a cottage for $2250. The taxes were $43; repairs, $32; insurance, $3.50. How much did this family save a year by owning their own home?

21. A house that rents for $460 a year is for sale. How much should I offer for it to realize 7% interest on my investment, if the taxes are $55 a year, and if I allow $40 for repairs and $50 for depreciation each year?

22. I rent a house for $45 a month and realize annually 8% on the money invested after paying $108 for taxes and $16 for repairs. What is the value of the property?

23. Mr. White purchased a lot and built a double house upon it at a total cost of $7000 and then rented it for $37.50 per month a side. He paid $84 annually for taxes and $46 for repairs. What per cent did his investment yield?

24. Mr. Johnson purchased a corner lot for $1200. He was assessed $300 for street and sidewalk improvements by the city, and was taxed $18 a year. Two years after buying, he sold the lot for $1900. Find his per cent of profit on the total investment after allowing for a loss of $120 interest during the two years.

25. A real estate dealer bought a house and lot for $1650. The house was remodeled at a cost of $800, and $250 was paid for street improvements. He then exchanged the property for 40 acres of land, which he immediately sold at $80 per acre. What was his per cent of gain on the total investment?

26. Mary Barton bought a lot for $900. She was assessed $100 for street and city improvements and paid taxes of $10 a year. At the end of 5 years, she sold the lot for $1400. What was her profit, after deducting 5% interest on the original cost of the lot?

27. Albert Wright, who bought a lot at the same price and at the same time as Mary Barton, and who had paid the same assessment and taxes, was obliged to sell his lot at the end of 5 years for the amount he had originally paid for it. How much did he lose, including 5% interest on the cost of the lot?

28. Joseph Little bought a farm for $5300. He spent $220 in improvements. He then sold the farm for $5800. What per cent did he make on his investment?

29. A lot which has a frontage of 35 ft. on the principal business street of a city was sold for $315,000. That was how much per front foot?

*30. Charles Jonas bought a farm of 180 acres for $8500. He ran the farm for several years, during which time he spent $4000 on permanent improvements. He then sold it for $85 an acre. What per cent did he make on the investment, not including interest?

20. Building and Loan Associations

Building and Loan Associations [1] encourage systematic saving, and help persons to purchase or build homes of their own, and to accumulate funds for future needs.

To save money through a Building and Loan Association, a person takes from one to forty shares in the company. The deposit required is $1.00 per month on each share.

[Use pencil only when needed.]

1. At $1.00 a month, how much do I deposit on 20 shares each month? In a year?

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[1] In some states these are called Coöperative Banks, Savings and Loan Associations, etc.

2. Monthly payments are continued until, with the interest, they amount to $200 on each share. This usually requires 12 years. At $200 each, how much would my 20 shares then be worth?

3. Paying $1.00 a month, how much do I pay in per share in 12 years? How much on 20 shares?

4. How much more do I receive at the end of 12 years than I pay in, on one share? On 20 shares?

5. In case members neglect to pay their dues on or before a specified day of the month, they are fined usually 2¢ a month on each dollar due. Delano Townsend failed to pay his dues on 14 shares for the months of July and August. How much was his fine?

6. Building and Loan Associations will loan money to members on real estate as security. Myron Webster borrowed $2000 to help build his house. How much would he be required to pay monthly for 10 shares at $1.00 each and interest on $2000 at 6% per year.

7. Including monthly payments and interest, how much would Myron Webster pay in 12 years when his debt would be discharged? (See problem 6.)

8. If Myron Webster borrowed the $2000 from a Savings Bank, paying interest at 6%, how much interest would he pay to the bank in 12 years?

9. In a recent year the number of Building and Loan Associations in the United States was 7269. That same year the number of the National Banks in the country was 7597. The number of Building and Loan Associations was what per cent of the National Banks?

10. That same year the total capital stock of the National Banks was $1,075,733,375, while the paid-in capital stock of the Building and Loan Associations was $1,503,770,848. How much more than the capital stock of the National Banks was the capital stock of the Building and Loan Associations?

21. Stocks and Bonds

I. CORPORATIONS

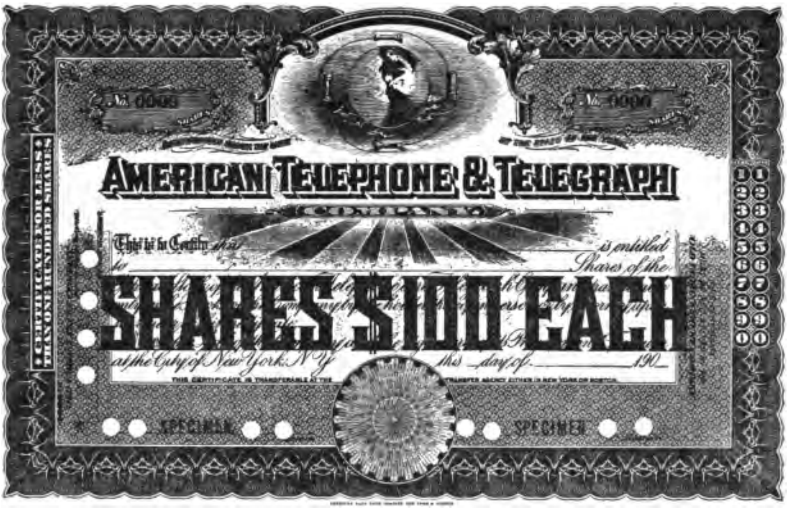
Much of the business of the world is carried on by **corporations.** A corporation is a company authorized by law to carry on a business, the owners together furnishing the capital, or money, required.

If, for example, an electric light company is to be organized requiring a capital of $1,000,000, those who organize the company might arrange to borrow $600,000, secured by a mortgage on the property. By dividing the balance of $400,000 into 4000 shares of $100, the organizers of the company could each buy as many of these shares as desired, and could sell the remaining shares to persons who wish to invest in the enterprise. A person desiring to invest $100 would buy one share; a person desiring to invest $1000 would buy 10 shares.

Each purchaser of these shares receives a certificate called a **stock certificate.** This certificate states the number of shares of stock in the company the holder has purchased, and the value given each share, called its **par value,** usually $100. The holder of a stock certificate is called a **stockholder** in the company. He is entitled to as many votes in the company's meetings as he has shares of stock.

A part of the capital borrowed by a corporation is often obtained by selling **bonds.** A bond is a certificate indicating that the holder has loaned the company a stated sum of money, which is to be paid on a specified date when the bond "matures" or becomes due. It also states the rate of interest which the holder is to receive on the par value of the bond until the date of maturity.

At the end of stated periods, a corporation making a profit over its running expenses and the interest on its bonds, may divide a portion of its profits among its stockholders. Such divisions of the the profits are termed **dividends** and are declared as a per cent of the par value of the stock. Thus, a company declaring a quarterly dividend of 2%, pays at the end of a three months period $2 on each share of stock having a par value of $100.



No. 0000

No. 0000

AMERICAN TELEPHONE & TELEGRAPH

COMPANY

This is to Certify that ________ is entitled to ________ Shares of the

SHARES $100 EACH

at the City of New York, N.Y. this ___ day of ________ 190_

THIS CERTIFICATE IS TRANSFERABLE AT THE ... TRANSFER AGENCY EITHER IN NEW YORK OR BOSTON.

CERTIFICATE FOR LESS THAN ONE HUNDRED SHARES

SPECIMEN

SPECIMEN

1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 8
9 9
0 0

A Stock Certificate

In many companies not all stockholders have an equal right in the profits. The stock is divided in such companies into **preferred** and **common** stock. Preferred stock, as its name indicates, has preference over the common stock in the profits; it is entitled to dividends at a fixed rate before the common stock can receive dividends. After the running expenses of the corporation, the interest on its bonds, and the dividends on the preferred stock have been paid, the balance of the profits of the business, if any, belongs to the holders of the common stock and may be distributed as dividends upon the common stock.

A bond is a much safer investment than stock in the same company because the holder of a bond is promised that the par value of his bond will be repaid when it matures, whereas the holder of a stock certificate has no guarantee that his investment will ever be repaid. Moreover, interest on bonds must be paid as it comes due, whereas dividends on stock are paid only when earned by the corporation and declared by the management.

Stocks and bonds are bought and sold in a market called **a stock exchange.** New York, Chicago, and other large cities have such markets. Of these, "Wall Street" in New York City is the most famous. On the exchange, stocks and bonds are bought and sold by agents called **stock brokers.** The brokers bid for the stock placed on sale just as men do at an auction. Brokers charge as their commission a fee of about ⅛ of 1 per cent on the par value of stocks and bonds bought and sold. This fee is called **a brokerage.** At ⅛% the brokerage for buying a $100-share of stock would be —¢. The brokerage for selling a $1000 bond would be $—.

Stock is said to be sold **at par** when it sells for the sum named on the face of the stock certificate, usually $100. Stock is said to be **above par** when it sells for more than its face value. It is said to be **below par** when it sells for less than its face value. Thus, stock with a face value of $100 is at par when it sells for $100 a share; it is above par when it sells for $101; and below par when it sells for $99.

II. STOCKS — THEIR COST AND INCOME[1]

In the daily papers will be found reports of the prices at which the stocks of the leading corporations are selling. These reports are called **stock quotations.** Some stock quotations for a given day were as follows:

	Par	High	Low	Dividend
American Beet Sugar	100	96½	96	Q. Jan.
Baldwin Locomotive Works	100	145⅜	141½	....
Central Leather	100	109⅝	105⅝	Q. Feb.
Central Leather pfd	100	106¾	106¾	Q. Jan.
Delaware, Lackawanna & Western	50	183	182	Q. Jan.
General Electric	100	168¾	163	Q. Jan.
Pennsylvania	50	43⅞	43⅜	Q. Feb.
Southern Railway pfd	100	63⅜	62¾	A. & O.
Union Pacific	100	126	125¾	Q. Jan.
Union Pacific pfd	100	70	69⅜	A. & O.
U.S. Steel	100	108	106⅝	Q. Mar.
U.S. Steel pfd	100	115	114⅜	Q. Feb.

---

[1] A committee of pupils may be appointed to keep a record on the blackboard of the daily newspaper quotations of some of the leading stocks.

The abbreviation *pfd.* indicates that the stock is preferred. Stocks not so designated are common stocks.

[Without pencil.]

1. Which of the stocks listed above are preferred? Which are common?

2. Which of the stocks are railroad stocks? Which are industrials?

3. Which of the stocks have a par value of $100? Give the par value of each of the other stocks listed.

The abbreviations in the last column indicate when dividends, if any, are paid. The dotted lines indicate that no dividends are expected. Q. followed by the abbreviation for a month indicates that the dividends are paid quarterly, beginning with the month named. Thus, Q. Feb. means that dividends may be expected in February, May, August, and November.

4. Tell whether dividends are expected in the case of each of the stocks listed on page 180, and, if so, in what months they will be paid.

5. How much was the difference in the high and low prices, for each of the first four stocks?

6. In the case of which stocks do the common stocks bring higher prices than the preferred? Can you give a reason for this?

7. Name the stocks that are below par. Those above par.

[With pencil.]

Including brokerage of $\frac{1}{8}$ of 1% (on the par value), find the cost of the following stocks at the "low" prices given in the table on page 180:

8. 10 shares of American Beet Sugar.

9. 10 shares of Baldwin Locomotive Works.

10. 25 shares of Southern Railway pfd.

11. 24 shares United States Steel; 24 shares of United States Steel pfd.

12. 1500 shares of Central Leather; 250 shares of Central Leather pfd.

13. 7 shares of Delaware, Lackawanna & Western.

14. 250 shares of General Electric.

15. 500 shares of Union Pacific; the same amount of Union Pacific pfd.

16. A broker sells for me 32 shares of American Beet Sugar at 96½. After deducting his brokerage, how much does he remit to me?

17. Find how much a broker should remit to a customer after selling for him 276 shares of New York Central at 75½.

18. A man bought 120 shares of mining stock at 105, and was glad to sell it at 30. Including brokerage for both buying and selling, how much did he lose by the transaction?

19. Mr. Johnson buys at 119½, 25 shares of Union Pacific, paying 8% dividends. What is the amount of his annual income from this stock?

Since dividends are declared on the par value of the stock, he receives $8 on each $100 share. On 25 shares he receives $8 × 25.

20. Find the income from 200 shares of stock yielding an annual dividend of 7%. Par value of stock, $100.

21. I bought 40 shares of National Bank stock at 160. This stock pays a semi-annual dividend of 4%. Find my annual income from this investment.

22. What income will be derived from investing $5887.50 in 5% stock, quoted at 98?

23. Find the loss on 276 shares of New York Central bought at 84¾ and sold at 75½, including brokerage for both buying and selling.

*24. A man sold 150 shares of Erie R.R. stock, quoted at 30⅛, and with the money bought stock in an industrial stock quoted at 124⅞. What amount did he receive when the industrial stock paid a dividend of 6%?

25. Read from the financial page of the daily newspapers some of the stock exchange quotations. Explain each quotation.

III. Bonds

The market values of bonds do not vary so much as the quotations on stocks. Can you tell why?

Railroad and industrial bonds are usually issued for $1000 or $500.

RAILROAD AND INDUSTRIAL BONDS

	Date of Maturity	Bid	Asked	Interest paid
Baldwin Locomotive 5s	1940	100½	100¾	M. & N.
Central Leather 5s	1925	97¼	97½	A. & O.
General Electric 5s	1952	94½	95	M. & S.
Pennsylvania 4s	1952	77¾	79	M. & N.
Pennsylvania 4½s	1921	97¾	97⅞	J. & J.
Southern Railway 5s	1994	79	88¼	J. & J.
Union Pacific 4s	1947	83⅝	84	J. & J.
U.S. Steel 5s	1963	99¼	99½	M. & N.

[Without pencil.]

1. Read in full the facts given in the table above about each class of bonds.

Thus: The Baldwin Locomotive Company's bonds pay 5% interest; they mature (are bought back at par by the corporation) in the year 1940; 100½% of the face value of the bond is the price bid, and 100¾% is the price asked; interest is paid in March and November. (Allow 6 months between the dates.)

2. How much interest would be received in March on a Baldwin Locomotive $1000 bond? In October?

3. Tell how much interest would be received on a $1000 bond at each interest period, in the case of each of the other bonds listed above.

4. At the price asked for Union Pacific 4s in the list above, how much would three $1000 bonds cost, including brokerage of $\frac{1}{8}$%?

5. Including brokerage of $\frac{1}{8}$%, what would be the cost of two $500 bonds bearing 4$\frac{1}{2}$% interest, bought at 102?

STATE, COUNTY, CITY, AND TOWN BONDS

States, counties, cities, and towns often borrow money by the sale of bonds.

[With pencil.]

1. A city borrowed $65,000 on a bond issue, Oct. 1, 1920, for the building of bridges. The bonds were 20-year bonds, bearing interest at 5$\frac{1}{2}$%. What is their date of maturity? What annual interest would a purchaser of one of these $500 bonds receive?

2. A School Board issued $500 bonds at 101$\frac{1}{2}$. How much did 3 of these bonds cost, including brokerage of $\frac{1}{8}$ of 1%?

3. These bonds pay 4$\frac{1}{2}$% interest. What annual income would the 3 bonds yield?

4. To raise funds to build a high school, a School Board sold $100,000 worth of $1000 bonds, paying 4$\frac{1}{2}$% interest. What amount is paid annually as interest on these bonds?

*5. Select five bonds from the stock exchange quotations in the daily newspapers and keep a record for a month of the daily changes in these quotations. Compare with changes in stock quotations.

LIBERTY BONDS

Persons lend money to the United States Government just as they do to corporations. To finance the war with Germany, the United States Government sold bonds called Liberty Bonds, which were bought widely by the people of the country. The following table gives the necessary facts about the five series:

No. of series	Date of issue	Rate of interest[1]	Date of maturity	Interest paid on 15th of
First	June 15, 1917	3½%, 4, 4¼%	June 15, 1947	June–Dec.
Second	Nov. 15, 1917	4, 4¼%	Nov. 15, 1942	May–Nov.
Third	May 9, 1918	4¼%	Sept. 15, 1928	Mar.–Sept.
Fourth	Oct. 24, 1918	4¼%	Oct. 15, 1938	Apr.–Oct.
Fifth	May 20, 1919	3¾, 4¾%	May 20, 1923	June–Dec.

A **registered bond** bears the purchaser's name and is not transferable without his indorsement. A **coupon bond** does not bear the purchaser's name. The interest may be collected by any one holding the detached interest coupon.

Bonds should be kept in a safe place, preferably at a bank, for if lost or stolen, unless registered, they cannot be replaced. Many banks will keep them for their depositors, crediting their accounts as the interest falls due.

[Use pencil when needed.]

1. If possible, bring Liberty Bonds to the class so that your classmates may become familiar with the different issues.

2. What would be the annual income from a 4% $100 Liberty Bond? From a $1000 3½% Liberty Bond?

3. With interest paid every six months, how many interest coupons would be attached to a bond issued June 15, 1917, and payable June 15, 1947?

4. What is the value, when due, of an interest coupon cut from a $500 bond bearing 4¼% interest?

5. On what dates will interest be due on a Liberty Bond, the first interest coupon of which fell due June 15, 1919, and which bears interest each six months thereafter until it matures, May 20, 1923?

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[1] In the case of the First, Second, and Fifth Series, the interest varies as indicated in the table, with the special form of bond held.

6. Mary Haynes received a Christmas present of a $50 Liberty Bond bearing interest at 3½%, payable in thirty years. Should she keep the bond until it matures, how much will she have received for the coupons attached to the bond?

*7. Make and solve two problems on Liberty Bonds, if possible, basing them on your experience, or that of friends, in purchasing the bonds, including the interest received from them.

22. Thrift and War-Savings Stamps; and War-Savings and Treasury Savings Certificates

In order to help meet its expenses and encourage thrift, the United States Government borrows money, issuing certificates promising to pay these loans at stated times with specified rates of interest. These certificates are in the form of Thrift and War-Savings Stamps and War-Savings and Treasury Certificates. One of the best investments boys and girls can make with their savings is thus to loan them to the Government.

Thrift Stamps are stamps which may be purchased at any post-office at 25¢ apiece and affixed to a Thrift Card.

War-Savings Stamps. The holder of sixteen Thrift Stamps, upon paying from 12¢ to 23¢ additional, may exchange his Thrift Card for a War-Savings Stamp. The War-Savings Stamps vary in price from $4.12 to $4.23 according to the month in which they are purchased. They increase in value every month until the date of maturity, five years from the date of issuance, when they are worth $5.00 each, payable at a post-office. This includes interest at 4% compounded quarterly. If the War Stamps are registered when purchased, the Government will repay the owner if the stamps are lost.

War-Savings Certificates contain spaces for twenty War-Savings Stamps. If the twenty spaces are filled with twenty War Stamps of the same year, the holder will receive $100 in cash at the date of maturity of the stamps.

Treasury Savings Certificates are certificates that may be purchased at the larger post-offices or banks. They bear interest at 4% compounded quarterly.

[Use pencil when needed.]

1. Bring to class Thrift Cards and War-Savings Certificates, with stamps affixed, and let your classmates examine them.

2. Show that $4.12, bearing interest at 4%, compounded quarterly, will amount to $5.00 in five years.

3. January 1, 1918, Franklin bought two War-Savings Stamps at $4.12 each. How much will he receive for them January 1, 1923?

4. Make and solve three problems on Thrift and War-Savings Stamps and War-Savings Certificates.

23. Investments in Business

Many persons invest their money in business enterprises which they conduct themselves, or entrust to others to manage. In order to see whether his business is paying or not, a man keeps an account of the expenses and income of his business. He puts on the expense side the cost of goods, rent, heat, light, labor, insurance, taxes, and interest on his capital. On the income side he puts all the moneys he receives.

All the expenses except the cost of goods and the selling expense, in a merchant's account, and all except the cost of materials and labor on these materials in a manufacturer's account, are called **overhead charges**.

The difference between the cost of goods and the money received is called the **gross profit**. The difference between the total expenses and the total income is called the **net profit**. Which is the real profit?

The net profit expressed as a number of hundredths of the total receipts gives the per cent of net profit. The net profit expressed as a per cent of the capital gives the "return on the investment."

(1) The capital invested in a dry-goods business is $30,000; the cost of the goods sold is $25,000; the expenses of carrying on the business are $10,000; the total receipts, $40,000. Find the gross profit, the per cent of net profit, and the return on the investment.

$40,000 − $25,000 = $15,000, the gross profit.

$40,000 − ($25,000 + $10,000) = $5,000, the net profit.

$$\frac{\$5{,}000 \text{ (net profit)}}{\$40{,}000 \text{ (receipts)}} = 12\tfrac{1}{2}\%, \text{ the net profit.}$$

$$\frac{\$5{,}000 \text{ (net profit)}}{\$30{,}000 \text{ (capital)}} = 16\tfrac{2}{3}\%, \text{ the return on the investment.}$$

[Without pencil.]

1. What capital is needed by a grocer starting in business, if his store furnishings cost $250; his stock of goods, $1500; a wagon, $75; a horse, $125; and if he needs $100 for other expenses?

2. $10,000 was invested in a dry-goods business, which yielded $2000 net profit. What was the return on the investment?

3. Find the return on the investment when $5000 invested in a shoe store yields a profit of $2000 a year.

4. What is the return on an investment of $6000 in a furniture store which yields a profit of $720 annually?

5. A building contractor invests $4000 and makes a profit of $6000. Find the return on the investment.

[With pencil.]

6. Find the amount of capital needed by a grocer to buy a store, the furnishings of which will cost $350; the groceries at wholesale, $1400; two wagons, each $90; two horses, each $150. If his additional expenses for the first year amount to $800, how much money will he have invested by the end of the first year?

7. The following is the expense account of a florist whose capital is $30,000:

EXPENDITURES		RECEIPTS
Cost:		Sales $50,000
Plants,	$23,000	
Labor,	10,000	
Overhead charges:		
Rent,	6,000	
Light,	1,800	
Heat,	4,000	
Incidentals,	1,000	
	$45,800	
Net profit:	4,200	
	$50,000	$50,000

The per cent of net profit is: $\frac{4200}{50000} = - \%$.

The per cent of profit on the investment is: $\frac{4200}{30000} = - \%$.

8. How much capital is required by a farmer to take over a farm that is selling for $3300 and stock it at a cost of $900? If the net earnings from the farm the first year are $800, what is the gain per cent on the investment?

9. A hardware merchant with a capital of $12,000 receives from his sales $33,000 in a year. The cost of the goods was $22,000. His overhead expenses were as follows: fuel, $175; light, $100; rent, $900; taxes, $173; insurance, $145; freight, $188; express, $108; advertising, $100; horses, $550; telephone, $72; clerk hire, $2625; interest, $100; incidentals, $900. Balance the account and find the return on the investment.

10. A dry-goods merchant has $12,000 invested in his business. Last year he paid $15,000 for goods. His overhead expenses were as follows: rent, $1000; heat, light, and insurance, $1700; incidentals, $150; clerk hire, $7000; interest, $150. His total receipts for the year were $35,000. What was the return on the investment?

11. This is a country grocer's account. Balance it, find the per cent of net profit based on the sales, also the per cent of profit on the money invested: Capital, \$5000; cost of goods, \$30,345.51; clerk hire, \$1000; rent, \$200; fuel and light, \$75; freight, \$350; insurance, taxes, and interest, \$160; incidentals, \$100; losses on accounts, \$75. The sales for that year amounted to \$36,546.80.

*12. A man started a livery stable with the following equipment: 6 carriages at \$500 each; 2 coupés, \$900 each; 3 coaches, \$1200 each; 8 horses, \$150 each and 4 horses, \$200 each; harnesses, \$600; blankets and robes, \$95; miscellaneous items, \$85. If his running expenses for the year come to \$3000 and he allows \$600 for repairs and depreciation, how much must his receipts be to make 8% on his investment?

24. Review: Choice of Investments

If you had money to invest, which of the following forms of investment would you consider, and which would you reject at once? Give the reason for your decision in each case.

[Without pencil.]

1. A newspaper advertisement: "Close corporation operating successfully offers limited amount of capital stock, par value \$100, at \$75 per share. Stock should pay 20% in 6 months. Any subscription from one share up will be accepted."

2. Stock at par in a new electric light and power company in a rapidly growing city. Some of the most reliable men in the community are organizing the company. The officials of the company after careful expert investigation promise to supply the electricity at a reasonable rate. They expect to be able to pay an annual dividend of 6% to stockholders.

3. Bonds of a street railway company bearing $4\frac{1}{2}$% interest and selling at 103. The company has managed the street-car system of the city for 20 years and always paid 6% dividends to stockholders as well as the interest on its bonds.

4. United States bonds, paying 3% interest and maturing in 1946, quoted at 92.

5. Twelve-room double house in excellent condition; in a good locality; rent $25 each side per month; taxes $75. Price $5200.

6. A savings bank pays 4% interest, compounded semi-annually. Accepts deposits up to $1000 from a depositor.

7. Advertisement: "Rich men keep their money out working for them. Why not take that money of yours in the stocking or between the bedticks and invest it with the Fidelity Mining Company and let it earn you 10% dividends every 6 months? Write to-day."

8. A building lot in a tract of land near a growing city. The lot is well situated, and the price seems reasonable.

9. Advertisement: "Come out to Wheatland Park next Saturday to see the beautiful lots we have for sale. $5 down, with easy future payments, will secure one of these desirable lots. Your carfare, both ways, paid if you purchase a lot."

10. Liberty bonds, selling at 98, that pay 4¼% interest and mature in 1938.

11. Shares in a Building and Loan Association, averaging 5½% interest, that require a monthly payment of $1 per share for 12 years.

12. Advertisement: "The scramble is on for Malga Oil stock. 20 cents a share. Such an avalanche of orders, it may be necessary to advance the price without further notice. Wire your order at our expense now."

13. Bring newspapers to class to study advertisements of investments. Let each member of the class read an advertisement and tell, first, whether it is probably safe or unsafe and why; and, second, if safe, whether or not it offers a fair return on the investment.

14. A common proverb reads: "Do not carry all your eggs in one basket." Why is it unwise to put all one's savings into one form of investment?

*15. Imagine that you have $10,000 to invest. Make a list of investments that you would select. Compute the yearly income from each investment and the total yearly income. Read the list to the class for discussion.[1]

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[1] TO THE TEACHER: It will be profitable to give this exercise, with larger or smaller imaginary sums of money to invest, on successive days, until pupils can apply the two important principles to be observed in making investments: (1) The higher the rate of income offered by an investment, the greater the risk, usually, of losing the money invested; and the safer the investment, usually, the lower the rate of its income. (2) Investments should be wisely scattered, so that a loss in the case of an investment will not have a disastrous effect.

Impress upon pupils, also, the wisdom of consulting trustworthy persons with regard to investments. A local banker or a reliable stock or bond broker will gladly furnish information and advice without charge. It is a good rule never to decide upon an investment until information about it has been obtained from some other source than the person who wishes to profit by the investment.

It is not expected that pupils will develop judgment and skill in selecting investments. These will come only with experience and maturity. But, if the lesson of "Safety first" in making investments is impressed upon pupils, even in an elementary way, it will help largely to prevent later their throwing away their savings in foolish ventures, alluringly presented by dishonest persons.

CHAPTER V. BORROWING AND LOANING

25. Reasons for Borrowing

It is a dangerous practice to borrow money merely for one's own pleasure or to gratify a desire for some luxury such as an automobile; but there are times when business men find it advisable to increase their working capital temporarily. Thus, a manufacturer may need to borrow to purchase stock and pay his employees while his goods are being made. When his goods are sold, he can readily repay the loan. Or, a farmer may need additional money to assist in harvesting his crops. Or, a man may borrow to help build a home.

Those who have more money than they require for their immediate needs are glad to loan, either as an accommodation or as an investment, when it can be done safely and when the interest will bring in a reasonable return. Individuals sometimes make such loans, but the banks furnish by far the most of the funds used for this purpose.

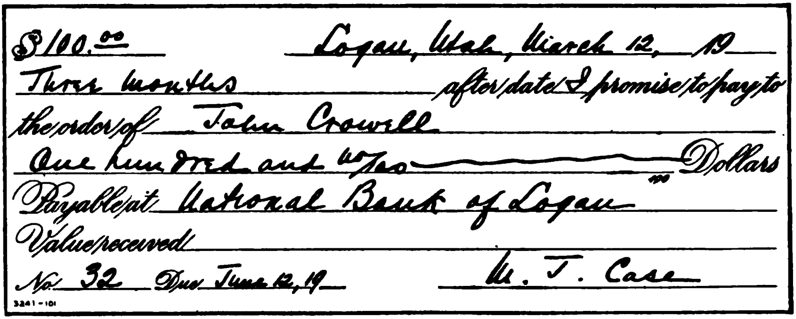
26. Borrowing from Individuals

I. THE PROMISSORY NOTE

It is customary to put into writing all promises to pay money The written promise is called a **promissory note.**

A promissory note is a written promise to pay a specified sum of money at a stated time.

The sum borrowed is called the **face** of the note. The **date of maturity** is the time at which the note falls due and is to be paid.



$100.00 Logan, Utah, March 12, 19

Three months after date I promise to pay to

the order of John Crowell

One hundred and no/100 Dollars

Payable at National Bank of Logan

Value received

No. 32 Due June 12, 19 W. J. Case

3241-101

Promissory Note

The person who signs the note and is to pay the money is the **maker**, and the person to whom the money is to be paid is the **payee.** The place of payment given is usually the maker's bank. The words "Value received," although not essential, are generally included.

[Use pencil only when needed.]

1. In the note given above, what is the face? Who promises to pay this amount? To whom is it to be paid? When? Who is the maker? Who is the payee? What is the date of maturity?

2. Write a promissory note in which James McClellan agrees to pay $50 to George Mosely, six months after date.

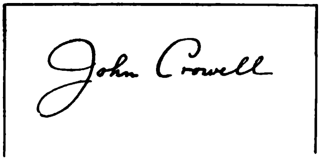
Give date of maturity for each of the following:

3. Note dated Jan. 3. Due in 3 months.
4. Note dated Sept. 9. Due in 60 days.
5. Note dated Mar. 10. Due in 6 months.
6. Note dated Nov. 20. Due in 90 days.
7. Note dated Mar. 8. Due in 120 days.

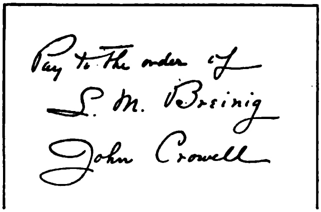
When a note is made payable in a given number of *days* after date, the exact number of days must be used; but if it is made payable a given number of *months* after date, even months are used. Thus, a note dated Nov. 1 and payable 60 days after date would mature December 31; if it were payable 2 months after date, it would mature Jan. 1.

II. INDORSEMENT OF A NOTE

The payee sometimes wishes to sell a note before it comes due. To do this, he indorses the note by writing his name across the back of it, thus indicating that he will be responsible for its payment when it fails due, should the maker fail to pay. (The note on page 194, John Crowell would indorse as shown here at the right.) Or, the payee may make it payable to some third person or order, by indorsing it as shown below. With either form of indorsement the note becomes **negotiable**; that is, it may be transferred from one person to another like a check, and the maker must pay the person holding the note when it falls due. If he should fail to do this, each previous indorser may be held responsible for its payment.



John Crowell

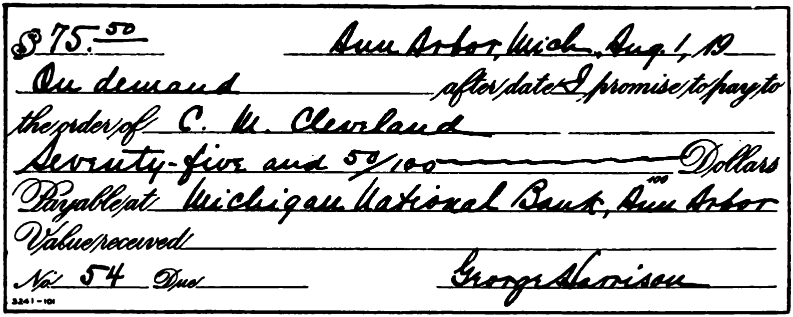


Pay to the order of
S. M. Breinig
John Crowell

A note is sometimes indorsed by a second person or by several persons as a guarantee that it will be paid when due. Each such indorser can be held responsible for the payment of the note, should the maker fail to keep his promise to pay at the specified time.

III. THE DEMAND NOTE

Instead of making a note payable at some specified time (called therefore a **time note**), the maker sometimes agrees to pay whenever the payee wishes the money and "demands" it. Such a note is called a **demand note.**



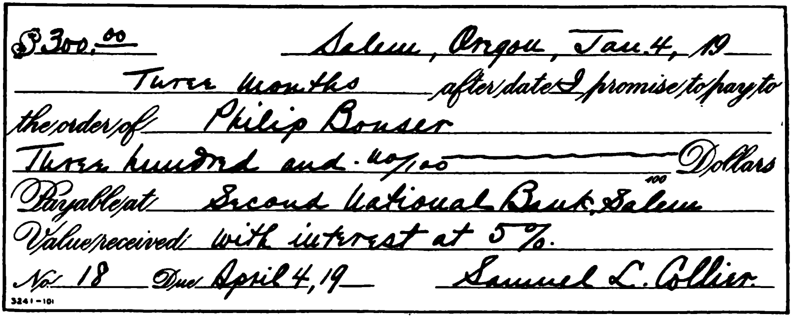
$75.50 Ann Arbor, Mich. Aug. 1, 19
On demand after date I promise to pay to
the order of C. M. Cleveland
Seventy-five and 50/100 Dollars
Payable at Michigan National Bank, Ann Arbor
Value received
No. 54 Due George Harrison
3241-101

Demand Note

In what particular is this note different from the note on page 194? Who is the maker? Who the payee? What is the face? Where was the note made? What is the date of the note? When is it to be paid?

IV. The Interest-Bearing Note

In the notes thus far studied, the maker has promised to pay only the principal at the date of maturity. Many notes provide for the payment also of interest from the date of the note till its payment. Such a note is called an **interest-bearing note.**



$300.00 Salem, Oregon, Jan. 4, 19
Three months after date I promise to pay to
the order of Philip Bouser
Three hundred and 00/100 Dollars
Payable at Second National Bank, Salem
Value received with interest at 5%.
No. 18 Due April 4, 19 Samuel L. Collier
3241-101

Interest-Bearing Note

1. In what respect is the form of note at the foot of page 196 different from the one on page 194? What is the face? Who is the maker? Who the payee? What is the rate of interest? How much money will Mr. Collier receive April 4?

2. Should the words "with interest" be included in the note, with no rate of interest given, the legal rate in the state where the note was made is paid. What is the legal rate in your state?

V. The Secured Note

Often a maker of a note is required to deposit with the payee certain property of value, such as stocks, bonds, or a mortgage[1] on real estate, as security for the payment of the sum named in the note. This property, known as **collateral security**, must be of sufficient value to cover fully the amount to be paid. A special form of note, called a **collateral note**, is used, in which the property is described.

VI. Problems

[Without pencil.]

1. Under what conditions should money be borrowed?

2. What is the danger in borrowing money to be used merely for pleasure?

3. Would a farmer be justified in borrowing money needed to gather his crops? Why?

4. What is a promissory note? Who is the maker? Who is the payee? What is the face?

5. In what respects is a promissory note like a bank check? In what respects is it different?

6. How can a note be made negotiable?

7. State the difference in wording between a time note and a demand note; between an interest-bearing note and a non-interest-bearing note.

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[1] See Definitions, at the back of the book.

8. Under what conditions should a person loan money?

9. Why do many business men make it a rule to refuse all requests to indorse notes as a guarantee?

10. Apply the following proverb to borrowing and loaning money: "A good name is to be chosen rather than great riches."

In computing interest on promissory notes, custom varies. In solving the following problems, unless the local custom is different, count 12 months of 30 days each, or 360 days, to a year. Count a term of 3 months, as $\frac{3}{12}$ or $\frac{1}{4}$ of a year, a term of 45 days as $\frac{45}{360}$ of a year, and a term from May 3 to July 8 as $\frac{66}{360}$ of a year. In computing the interest on notes banks usually find the exact number of days between the date of the note and the date of maturity.

(1) What amount is due at the end of 6 months on a note for $600 with interest at 5%? (2) On a note for $300 dated March 2 and maturing June 21, with interest at 6%?

(1) Term = $\frac{6}{12}$ or $\frac{1}{2}$ year.
Interest = $\$600 \times \frac{5}{100} \times \frac{1}{2}$, or $15.
Am't = $600 + $15, or $615.

(2) Term = 80 da. (29 da. in March + 30 da. in April + 21 da. in June.)
Interest = $\$300 \times \frac{6}{100} \times \frac{80}{360}$, or $4.
Am't = $300 + $4, or $304.

Find the amount due on the following notes: [With pencil.]

	FACE	PAYABLE	INTEREST
11.	$500	3 mo. after date	5%
12.	$2000	6 mo. after date	4%
13.	$450	30 days after date	6%
14.	$700	90 days after date	5½%
15.	$2500	60 days after date	4½%

16. E. A. Thurston borrows $2000 on April 7 and returns the money with interest at 5% on Aug. 15 of the same year. Find the amount that was due.

17. Find the amount due on a loan of $650 made Sept. 12 and returned with interest at 6% on Dec. 4 of the same year.

27. Borrowing from a Bank

I. Discount on Date of Note

Banks often lend money on promissory notes. A man wishing to borrow money will either take a promissory note payable to himself and ask a bank to lend him money on it, or he will write a promissory note making the bank the payee. In either case, if the man signing the note is known to be reliable, the bank will take the note, charge interest in advance on the loan, and later collect the amount of the note. The interest paid in advance on a loan secured by a promissory note is called **bank discount**; the amount paid on the note after deducting the bank discount is called the **net proceeds.**

What are the net proceeds on a 90-day note for $500 discounted at 6% on the date of the note.

Term of discount = 90 da. or $\frac{90}{360}$ of a year.
Bank discount = \$500 × $\frac{6}{100}$ × $\frac{90}{360}$, or \$7.50.
Net proceeds = \$500 − \$7.50, or \$492.50.

[With pencil.]

Find the net proceeds:

1. On a note for $200, payable in 3 months, discounted at 7%.

2. On a note for $800, payable in 4 months, discounted at 6%.

3. On a note for $1200, payable in 6 months, discounted at 5%.

4. On a note for $2400, payable in 90 days, discounted at 6%.

5. On a note for $360, payable in 60 days, discounted at 7%.

6. On a note for $400, dated June 1, payable Sept. 1, discounted June 1, at 6%.

7. On a note for $3000, dated July 15, payable Nov. 15, discounted July 15, at 7%.

8. A. W. Lang gives me a note for $400 due in 3 months' time. On the date of the making of the note, I take it to a bank where it is discounted at 6%. How much money do I receive?

*9. James Patterson wished to make a payment of $460 on a farm. For what sum must he write a note to borrow the money for 1 year from a bank which charges 8% discount?

*10. For what sum must a note be drawn for 60 days to obtain $495 at a bank, when discounted at 6%?

II. Discount after the Date of Note

Mathew Hale receives a note for $500 dated July 18 and made payable in 3 months. On what date does the note mature?

In finding the date of maturity when the time is given in months, reckon in calendar months; when given in days count the actual number of days.

A 3-months note dated July 18 is due October 18.
A 90-day note dated July 18 is due October 16.

On August 5, Mathew Hale presents the note to a bank for discount. How much does he receive if the bank discounts the note at 6%?

The term of discount in this case extends from August 5 to October 18. From August 5 to October 18, the time is 74 days;

Date of maturity Oct. 18.
Term of discount = 74 da.
Discount = $500 × $\frac{6}{100}$ × $\frac{74}{360}$, or $6.17.
Proceeds = $500 − $6.17, or $493.83.

In reckoning the term of discount, count the time from the date of discount to the date on which the note matures. In computing the time, use the method illustrated in the solution of the problem above. Cancel when possible to shorten the work.

Find the date of maturity: [Without pencil.]

1. Of a 30-day note dated July 5.
2. Of a 3-months note dated July 5.
3. Of a note for 20 days, dated Feb. 21, 1920.
4. Of a 6-months note dated Sept. 10, 1920.

[With pencil.]

5. A note for $1000 due in 3 mo. is dated March 1, 1920, and discounted at 6% on May 15 of the same year. How many days were there from the date of discount to the date of maturity? Find the discount.

Find the proceeds of the following notes (allow 29 days for February in leap year):

	FACE	TIME	DATE	DISCOUNTED	RATE
6.	$80	3 mo.	Jan. 7, 1920	Feb. 6, 1920	6%
7.	$480	60 da.	March 24, 1919	Apr. 8, 1919	5%
8.	$1400	1 yr.	April 5, 1920	Aug. 2, 1920	6%
9.	$60	30 da.	Feb. 26, 1920	March 12, 1920	8%
10.	$1500	4 mo.	Jan. 8, 1920	Jan. 23, 1920	7%
11.	$500	6 mo.	Jan. 1, 1921	Jan. 16, 1921	6%
12.	$2000	30 da.	March 15, 1919	Apr. 1, 1919	5%
13.	$4000	60 da.	June 10, 1919	June 20, 1919	6%
14.	$3500	90 da.	Aug. 2, 1921	Sept. 1, 1921	7%

III. DISCOUNT ON INTEREST-BEARING NOTES

[Use pencil when needed.]

1. E. A. Thurston gives H. H. Keller a 6-months note for $2000, promising to pay 5% interest. At the date of maturity what sum is due on the note?

H. H. Keller has the note discounted at 6% on the date that it is made. How much does he receive?

On an interest-bearing note the discount is computed on the face of the note plus the interest.

2. Find the net proceeds on a 90-day note for $3000 bearing interest at 5% and discounted at 6% on the date that it was made.

*3. Albert J. Stuart bought a piece of real estate from William Brown August 5, for $6500, paying $4000 cash and giving a 6-months note for the remainder. On this note A. J. Stuart was to pay 5% interest. What sum was due on the note at maturity?

*4. Wm. Brown sold the note to a bank on Nov. 5 paying 7% discount. How much did he realize from the sale of his property?

28. Interest Tables

Bankers and others who frequently compute interest use an interest table. A part of an interest table is shown on page 203.

The interest for months is given in the third vertical column to the left. The interest for any given number of days is found in the column under that number, opposite the required per cent.

Find the interest on $1000 for 2 months and 20 days, at 2%.

Interest for 2 mo.	$3.333
Interest for 20 da.	1.111
Total interest	$4.444

[Without pencil.]

With the table, find the interest on $1000 for:

1. 1 month 2 days, at 2%.
2. 2 months 19 days, at 3%.
3. 5 months 16 days, at 6%.
4. 3 months 9 days, at 5%.
5. 4 months 24 days, at 4%.
6. 5 months 11 days, at 2%.
7. What will $1000 amount to in 5 mo. 19 da. at 4%?

[With pencil.]

8. What is the interest on $2000 at 3% for 4 mo. 20 da.?

(The interest on $2000 will be twice the interest on $1000.)

9. Allan Page loaned $500 for 4 mo. 17 da. at 4%. What interest did he receive?

10. Find the interest on $2500 at 2% for 3 mo. 14 da.

INTEREST ON $1000

	Months		Days																													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2 per cent	1	1.666	0.055	0.111	0.166	0.222	0.277	0.333	0.388	0.444	0.500	0.555	0.611	0.666	0.722	0.777	0.833	0.888	0.944	1.000	1.055	1.111	1.166	1.222	1.277	1.333	1.388	1.444	1.500	1.555	1.611	1.666
	2	3.333																														
	3	5.000																														
	4	6.666																														
	5	8.333																														
3 per cent	1	2.500	0.083	0.166	0.250	0.333	0.416	0.500	0.583	0.666	0.750	0.833	0.916	1.000	1.083	1.166	1.250	1.333	1.416	1.500	1.583	1.666	1.750	1.833	1.916	2.000	2.083	2.166	2.250	2.333	2.416	2.500
	2	5.000																														
	3	7.500																														
	4	10.000																														
	5	12.500																														
4 per cent	1	3.333	0.111	0.222	0.333	0.444	0.555	0.666	0.777	0.888	1.000	1.111	1.222	1.333	1.444	1.555	1.666	1.777	1.888	2.000	2.111	2.222	2.333	2.444	2.555	2.666	2.777	2.888	3.000	3.111	3.222	3.333
	2	6.666																														
	3	10.000																														
	4	13.333																														
	5	16.666																														
5 per cent	1	4.166	0.138	0.277	0.416	0.555	0.694	0.833	0.972	1.111	1.250	1.388	1.527	1.666	1.805	1.944	2.083	2.222	2.361	2.500	2.638	2.777	2.916	3.055	3.194	3.333	3.472	3.611	3.750	3.888	4.027	4.166
	2	8.333																														
	3	12.500																														
	4	16.666																														
	5	20.833																														
6 per cent	1	5.000	0.166	0.333	0.500	0.666	0.833	1.000	1.166	1.333	1.500	1.666	1.833	2.000	2.166	2.333	2.500	2.666	2.833	3.000	3.166	3.333	3.500	3.666	3.833	4.000	4.166	4.333	4.500	4.666	4.833	5.000
	2	10.000																														
	3	15.000																														
	4	20.000																														
	5	25.000																														

*11. A. B. Brown has the following interest accounts: $1000 at 4%; $2000 at 5%; $1500 at 3%; $750 at 2%. What is his total income from these accounts for a quarter of the year?

*12. Make and solve three original problems in which you use the table on page 203.

29. Review

[Without pencil.]

1. At the date of maturity, how much would be due on a note for $10 that runs for 6 mo. at 5%?

Find the amount due at maturity on each of the following notes:

	FACE	TIME	RATE
2.	$100	2 mo.	6%
3.	$75	6 mo.	4%
4.	$150	9 mo.	8%
5.	$40	6 mo.	4½%
6.	$1000	1¼ yr.	6%
7.	$1500	3 yr.	5%
8.	$2000	4 mo.	6%
9.	$3000	8 mo.	5%
10.	$5000	1 yr.	5½%
11.	$10,000	3½ yr.	4%

[With pencil.]

12. Philip Savitsk borrowed $75 from Mark Levy, giving him a note payable in 1 yr. 6 mo., with interest at 6%. What sum did it take to cancel the note?

13. Find the interest at 5% that I would receive in loaning $375 on a demand note that was paid 3 years from the date of making the loan.

14. How much would I receive on a note for $1000, due in 3 months, discounted at 3½%?

Find the sum that would be received when each of the following notes is discounted:

	FACE OF NOTE	TIME OF DISCOUNT	RATE
15.	$500	6 mo.	4%
16.	$2250	45 da.	6%
17.	$6000	63 da.	3½%
18.	$10,000	1 yr. 6 mo.	5½%
19.	$7500	90 da.	7%

20. March 1, I borrowed $800 from a bank on a note bearing interest at 5%. If the date of maturity is June 15 of the same year, how much interest did the bank charge me? How much did I receive from the bank?

Find the bank discount and the proceeds on each of the following notes, discounted on the date of the note:[1]

	FACE	DATE OF NOTE	DATE OF MATURITY	RATE
21.	$75	Sept. 1, 1919	Feb. 1, 1920	7%
22.	$350	Mar. 25, 1919	Oct. 1, 1920	6%
23.	$15,000	Feb. 1, 1920	May 3, 1920	3%
*24.	$25,000	Apr. 17, 1918	June 30, 1920	4½%

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[1] Use the exact number of days.

CHAPTER VI. HOW TO COLLECT MONEY

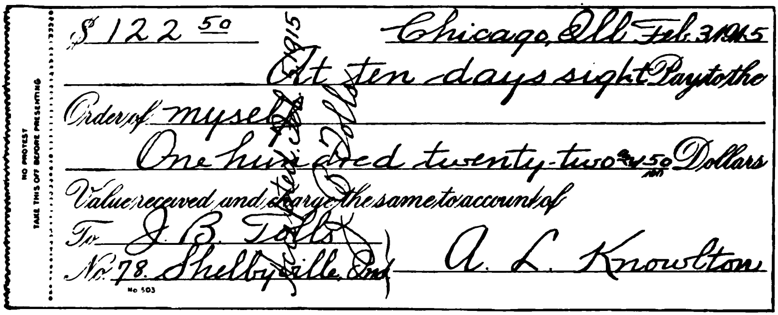
30. Itemized Bill and Monthly Statement

An honest person contracts only such bills as he can pay, and pays these promptly. The receipt of an itemized bill or a monthly statement will cause him to pay the account within a few days. But, unfortunately, many persons either willfully, or thoughtlessly, contract bills which they cannot or will not pay, and it becomes necessary often to use various methods for making collections.

31. The Commercial Draft

One such method of collecting money is the **commercial draft.**

A commercial draft is a written order by which one person directs a second person to pay a specified sum of money at a stated time, through a bank.



NO PROTEST
TAKE THIS OFF BEFORE PRESENTING

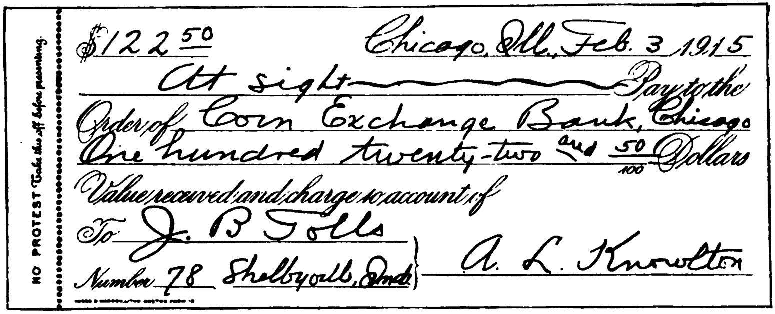
$122 50/100 Chicago, Ill. Feb. 3 1915
At ten days sight Pay to the
Order of myself
One hundred twenty-two & 50/100 Dollars
Value received and charge the same to account of
To J. B. Tolls
No. 78. Shelbyville, Ind. A. L. Knowlton
No 503

Feb. 5 1915 J. B. Tolls

Commercial Draft

J. B. Tolls, of Shelbyville, Indiana, owes A. L. Knowlton, of Chicago, $122.50. Mr. Knowlton sends the draft, filled in as above, to Mr. Tolls, who, if he wishes to pay it when due, writes across the face, "Accepted," with the date, and returns the draft to Mr. Knowlton. Mr. Knowlton then either turns the draft over to his banker for collection when due, or discounts it like any promissory note. In this transaction, Mr. Knowlton is said to "draw on" Mr. Tolls.

Instead of sending the draft direct, Mr. Knowlton might have forwarded it through his bankers. If he wished to request an immediate payment, he would use this form :



NO PROTEST Take this off before presenting.

$\$122^{50}$ Chicago, Ill., Feb. 3 1915

At sight Pay to the

Order of Corn Exchange Bank, Chicago.

One hundred twenty-two and $\frac{50}{100}$ Dollars

Value received and charge to account of

To J. B Tolls

Number 78 Shelbyville, Ind. A. L. Knowlton

Commercial Draft, Payable on Demand

In this case, Mr. Knowlton would send the draft, filled in as above, to the Corn Exchange Bank. This bank would endorse it and send it to a bank in Shelbyville, and it would be presented in person to Mr. Tolls. If he "honored" it, he would "accept it," making it payable at his bank, which would charge the amount to his account and forward it to Mr. Knowlton through the Chicago Bank.

Banks usually charge a fee equal to about $\frac{1}{10}$ of 1% of the face of the draft for making a collection.

If Mr. Tolls had not accepted the draft, thus refusing to pay the amount named therein, the draft, unless otherwise directed, would have been **protested** by a notary public, certifying that it had been duly presented and not accepted; it would then have been returned to Mr. Knowlton, who would be obliged to pay the protest fees. To avoid the cost of protesting, the words, "No protest" are frequently printed on the draft. (See drafts above.) Business men are careful to honor all drafts on them for amounts due, in order to keep their credit good. It is not customary to draw on a person without first notifying him that this action is to be taken.

[With pencil.]

1. A draft for $45 is collected at a charge of $\frac{1}{10}$%. How much is charged?

2. Halloway, Hibbard & Co. draw on W. R. Huston for bills due them, covering the following amounts: $25.00; $45.50; $74.50; $35.75. The bank through which the collecting is done charges $\frac{1}{10}$% for its services. What does it cost Halloway, Hibbard & Co. to have the money collected?

3. The Congress Bank of Washington charges $\frac{1}{10}$% for collecting a draft for $550, drawn by Lewis Brown & Co., of St. Paul, on Frank Black & Co., of Washington. What amount is sent Brown & Co.?

4. A publisher sends a bookseller, at a discount of 25%, 100 books at 80¢; 30 books at 72¢; 45 books at 76¢; 100 books at 36¢. The publisher draws on the bookseller for the amount due him, paying $\frac{1}{10}$% for the collecting. What are the proceeds?

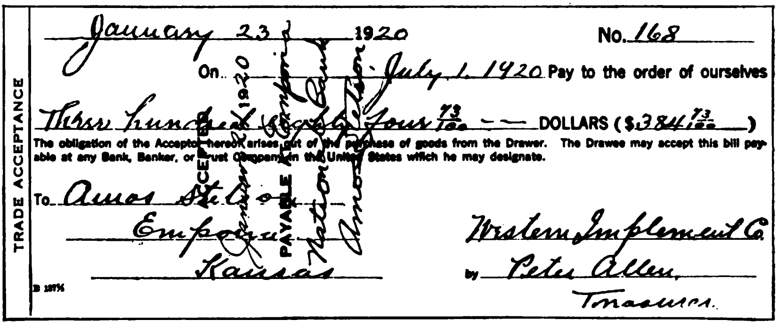
*5. A wholesale house sells goods listed at $3500 with discounts of 15% and 2% and draws on the buyer at sight. The bank charges $1.00 per $1000 for collecting. Find the net proceeds.

32. Trade Acceptances

A special form of draft which has been widely used in Europe for many years and which, under our Federal Reserve System of banking, will be used extensively in this country is the Trade Acceptance.

In the Trade Acceptance reproduced on page 209, Amos Stetson, having bought of the Western Implement Co. a bill of goods amounting to $384.73, promises to pay the bill on July 1, 1920, at the Emporia National Bank where he has an account. He indicates this promise by writing across the draft made out against him by the Western

Implement Co.: "Accepted, Jan. 24, 1920, Payable at Emporia National Bank, Amos Stetson." The draft may then be discounted at a bank by the Western Implement Co. and collected when due, July 1, 1920, from Amos Stetson by the Emporia National Bank.



TRADE ACCEPTANCE

January 23 1920 No. 168

On July 1, 1920 Pay to the order of ourselves

Three hundred Eighty Four 73/100 — DOLLARS ($384 73/100)

The obligation of the Acceptor hereof arises out of the purchase of goods from the Drawer. The Drawee may accept this bill payable at any Bank, Banker, or Trust Company in the United States which he may designate.

ACCEPTED January 24 1920

PAYABLE AT Emporia National Bank

Amos Stetson

To Amos Stetson

Emporia

Kansas

Western Implement Co.

by Peter Allen,

Treasurer.

A Trade Acceptance

*1. Write a Trade Acceptance in which Samuel Hoover agrees to pay George Thomas, 3 months from date, $875 for a carload of lumber. Write the endorsement by which Mr. Hoover "accepts" the draft on the day the draft is made out.

*2. George Thomas discounts the draft described in problem 1, on the day that it was accepted, at 5% discount. How much did he receive from the bank?

33. Collecting Agencies

When all other means have failed, a bill is sometimes put into the hands of a lawyer or a collecting agency. Such pressure is brought to bear on the debtor as the case warrants or as the law permits. For the collection of such "bad debts" 5% to 10%, or more, is often charged.

[Use pencil only when needed.]

1. A bill amounting to $380 was collected by a lawyer. What was the cost of making the collection at 10%?

2. A man who owed $75 for rent moved to another city. A collecting agency in that city forced him to pay the obligation. If the agency's charge was 25%, how much did the landlord receive?

3. A collector received the following payments in one day: $15, $7.50, $22, $3.50. How much did he receive for his services, if his charge was 10%? How much did he remit on each item?

4. A lawyer brought suit for the payment of a bill of $150. The court ordered the debtor to pay the bill with the 6 months interest due at 6%. How much was he obliged to pay besides his lawyer's fees?

5. A man who owed a bill of $170 let it run for 3 years and was then obliged to pay it with interest at 5%. His lawyer's fee was $25. How much did it cost him to settle the bill?

CHAPTER VII. WHAT OUR GOVERNMENT DOES FOR US, AND HOW IT IS SUPPORTED

34. How our National Government Is Supported

Our national government spends enormous sums of money each year in preparing to protect us from the possible attacks of enemies and in promoting our welfare. Besides maintaining the army and navy, it pays pensions to those who have fought in our past wars; it contributes largely to the support of the Indians whose lands we have taken; it collects and distributes our mails; it coins our money; it reclaims waste land and encourages agriculture, fisheries, and forestry; it improves our rivers and harbors; it erects and maintains an efficient life-saving service; and it makes and executes laws and administers justice.

The national government derives its income chiefly from two sources: **import duties** and **internal revenue.**

I. IMPORT DUTIES

A tax, or tariff, levied by act of congress on goods imported from other countries is called an **import** or **custom duty.**

When the import duty is reckoned as a certain per cent of the cost of the goods, it is said to be an **ad valorem[1] duty.**

When the import duty is a fixed charge according to the number of articles or their weight, it is said to be a **specific duty.**

II. INTERNAL REVENUE

A tax collected by the national government on the incomes of individuals and of corporations and on articles manufactured in this country, such as alcoholic liquors, tobacco, playing cards, and oleomargarine, is termed **internal revenue.**

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[1] *Ad valorem* is a Latin phrase meaning "according to value."

Every citizen or resident of this country is required to pay to the national government an **income tax** of 4% of his net income up to $4000, and of 8% of his net income in excess of $4000, above allowed exemptions. A citizen or resident who is married or the head of a family is entitled to an exemption of $2000 and $200 for each child under 18 years of age. An unmarried citizen or resident is entitled to an exemption of $1000.

Any person whose net income is in excess of $5000 must pay an additional income tax, called a **surtax**, ranging from 1% to 65% according to the amount of his income.

Corporations are required to pay a tax on their entire net incomes.

[With pencil.]

1. The internal revenue receipts of the Government for a recent year were as follows: From income and corporation taxes, $2,839,027,938; distilled spirits and alcoholic beverages, $143,839,545; from tobacco, $156,188,660; from other items, $255,563,496. What were the total receipts?

2. The receipts from customs for the year referred to in problem 1 were $182,758,989. The custom receipts were how much less than the internal revenue receipts?

3. In a recent year 204,551 corporations paid taxes to the national government amounting to $181,723,944. What was the average assessment?

4. The tax on uncolored oleomargarine is ¼¢ per pound; on colored oleomargarine, 10¢ per pound. The Government in one year received $562,725 from the tax on colored oleomargarine and $829,606.40 on uncolored oleomargarine. How many pounds of each were manufactured that year?

5. At a duty of 30%, what is the duty on 60 dozen watch crystals, invoiced at $1.80 per dozen?

6. The duty on mattings for floors is 2½¢ per square yard. Find the duty on 125 sq. yd. of the matting.

7. The duty on 600 yards of silk at 45% ad valorem is $550. For how much a yard must the importer sell it to gain 20% on the cost, including the duty?

8. A merchant imported 1500 lb. of macaroni worth $5\frac{1}{3}$¢ per pound, paying a duty of 1¢ per pound. He sold the lot for $112.75. Find his per cent of gross profit on the cost, including the duty.

9. I paid 30% duty on a Swiss watch that cost $45. What was the total cost of the watch?

10. What is the duty on 100 dozen table knives invoiced at $2.25 a dozen, if the duty is 25% ad valorem?

*11. 300 pounds of perfume costing $2 a pound were imported with a duty of $.40 a pound and 60% ad valorem. It was sold by the importer in bottles, 24 bottles containing one pound of perfume, at 50¢ each. What was his gross profit?

12. The revenue to our Government from import duties decreased from $318,891,396 during 1914, the first year of the Great War, to $182,758,989 during 1918, the last year of the war. What per cent of decrease was the latter amount?

13. How much income tax must an unmarried man pay whose net annual income, after all allowable deductions are made, exceeds $1000 by $3785?

*14. How much income tax must a married man pay whose income tax report shows a yearly income of $4649, with allowable deductions, including the exemption of $2000, amounting to $2400?

35. What our State and Local Governments Do for Us

Name some of the things the state and local governments do for us. The protection of our health, life, and property is almost wholly in the hands of our city or town government, although most of the laws that the local governments enforce are made by the state.

I. THE FIRE DEPARTMENT

[With pencil.]

1. The total cost for the maintenance of a city fire department for a year was $60,823.25. It had 270 hydrants. It paid $15 water rent per hydrant. What per cent of the total cost was the cost for water?

2. A fire department has 106 horses. Each horse is fed ½ peck of oats and 10 pounds of hay three times a day. What is the expense of feeding for one year with oats at 85 cents per bushel and hay at $32 per ton?

3. In a recent year the average loss per capita from fire in the United States was $2.40. This was an average of how much for each 1000 inhabitants? For each 1,000,000?

4. Out of 2216 fires that occurred within one year in one of our large cities, 7% was caused by smokers' carelessness. Find the number of fires due to this one preventable cause alone.

5. The fireman is usually on duty 5 days of 24 hours each, in each week. What per cent of the time is he off duty?

6. Out of 127 engines, trucks, and other vehicles used by the fire department in a city, 70 are motor propelled and the rest drawn by horses. What per cent are drawn by horses?

7. During a period of 10 years, the total number of horses used in the fire department of a city decreased from 415 to 187. What per cent of the number of horses used 10 years previously were there in use at the latter date?

8. The total expenditures for one year of the fire department in a city of 805,977 inhabitants were $2,221,387. Find the average cost per person in that city.

9. The total loss by fire in the city referred to in problem 8 for that year amounted to $2,822,109. Find the ratio of this amount to the number of inhabitants.

10. The fire loss in that city (problems 8 and 9) for the preceding year had been $3,981,227. Find the per cent of decrease.

11. In this city (problem 8) there were 10,047 hydrants available for fire use. What was the ratio of the number of hydrants to the population?

12. Out of a total of 5174 fire alarms sent in to a fire department, 2628 were false or needless alarms. What per cent proved to be necessary calls?

*13. Make and solve a problem based on the fire department in your city or town.

II. The City Hospital

1. The total expense of a city hospital for a year was $93,594.57. In that year 3520 patients were treated at the hospital. What was the per capita expense?

2. Of the amount expended (see problem 1), 2.5% was required for the tubercular patients. How much money was spent for that purpose?

3. Of 67 tubercular patients, 39 were discharged as improved and 1 as cured. What per cent of the patients were benefited?

4. One of our larger cities spent, in one year, .77 of 1% of its total city expenditures for a consumptives' hospital. The total expenditures for the city were $26,020,513.77. How much money was used for this hospital during the year?

*5. This same city spent that same year (see problem 4) 2.4% on its other hospitals. How much money did this city spend in all on its hospitals? What per cent was this amount of the entire expenditures of the city?

III. Street Paving

The local government sees that the streets are graded, paved, and repaired.

1. A street is ¼ of a mile long and 24 feet wide. Twelve inches of native soil is removed. What is the cost of removing the soil at 80¢ a load? (A load = 1 cu. yd.)

2. The street is then covered with concrete 6 in. thick. The concrete costs $12 a cubic yard. How many square yards will a cubic yard cover? What will the concrete cost?

3. An asphalt street complete costs $4.50 per square yard. At this rate, how much would a contractor receive for making one mile of asphalt street 30 ft. wide?

IV. THE SCHOOLS

1. The following sums of money were spent for the maintenance of schools in a city for one year. Find the total amount spent.

Teachers' Salaries	$798,863.32
Industrial Training	145,015.48
Building and Grounds	178,940.82
Fuel	33,149.64
Janitors' Salaries	53,385.64
Miscellaneous	193,920.34

2. There were in that city 235,960 people. What was the per capita cost of the schools?

3. There were 869 teachers. What was the average salary per teacher?

4. During this same year, $1375 was spent for premiums on insurance of school property. In this city, school property is insured for 60% of its value at a rate of 1%. What was the value of the school property insured?

5. The total number of pupils enrolled during the year was 31,567. What was the average cost of the year's education per child?

6. In a recent year, one of the large cities spent on its schools 23.81% of its total expenditures for the city, which amounted to $26,020,500. Find the amount spent on the schools.

V. VARIOUS OTHER THINGS THAT THE LOCAL GOVERNMENT DOES FOR US

1. A town appropriated $8758 for the maintenance of its police department for a year, but only 97.5% of this amount was expended. What was the balance on hand at the end of the year?

2. A town expended $5000 for a site for its town hall and $17,611.24 for the building. The population of the town was then 5917. Find the per capita cost of the town hall.

3. A city maintains 1967 electric and 532 gas street lights. Electric lights cost $78 each per year; and gas, $30.25. What is the total expense for lighting?

4. A city employs 52 medical inspectors for school children at a salary of $80 per month. How much does this medical attendance cost for each school year of ten months?

5. It cost $111,004.90 to elevate a railroad track over a city street. The railroad company paid 75% of this; the city, 14%; the county, 6%; and the street railway company, the rest. What were their respective shares?

36. How State and Local Governments are Supported

I. TAX ASSESSMENTS

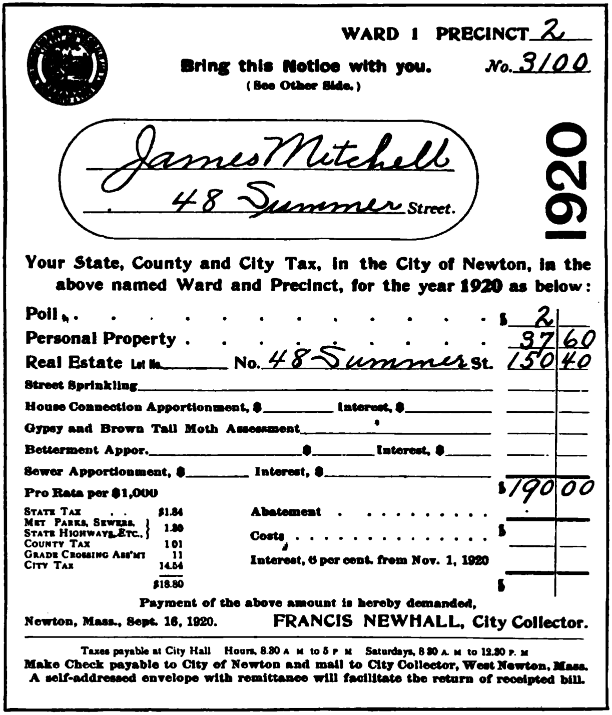
The expenses of a state, including its counties, cities, and towns, are met chiefly by levying taxes on property. The government officials first determine how much money will be needed to run the government for a year. Then, the property in the state is **assessed;** that is, officials in each community, known as **assessors,** put a value on the property in that community, The **tax rate** in any city or town is found by dividing the total expenditures to be met, including its proportion of state and county expenses, by the total assessment in that community. The tax rate is usually expressed, not as a per cent, but as so many mills on the dollar's worth of property, or so many cents on a hundred dollars' worth, or so many dollars on a thousand dollars' worth.

Besides property tax, states, counties, cities, and towns derive an income from a poll tax. In some states the poll tax is regarded as a tax paid for the privilege of voting. Another source of income is the various licenses and fees imposed by the state and cities, such as peddlers' licenses and various vehicle licenses.

II. CITY OR TOWN TAXES

[Use pencil only when needed.]

1. What is the present tax rate in your community?[1] What was the rate last year?



WARD 1 PRECINCT 2

Bring this Notice with you. (See Other Side.) No. 3100

1920

James Mitchell
48 Summer Street.

Your State, County and City Tax, in the City of Newton, in the above named Ward and Precinct, for the year 1920 as below:

Poll	$ 2	
Personal Property	37	60
Real Estate Lot No. ______ No. 48 Summer St.	150	40
Street Sprinkling		
House Connection Apportionment, $ ______ Interest, $ ______		
Gypsy and Brown Tail Moth Assessment		
Betterment Appor. ______ $ ______ Interest, $ ______		
Sewer Apportionment, $ ______ Interest, $ ______		
	$190	00
Abatement		
Costs	$	
Interest, 6 per cent. from Nov. 1, 1920		
	$	

Pro Rata per $1,000

STATE TAX	$1.84
MET PARKS, SEWERS, STATE HIGHWAYS, ETC.	1.30
COUNTY TAX	1.01
GRADE CROSSING ASS'MT	11
CITY TAX	14.54
	$18.80

Payment of the above amount is hereby demanded,

Newton, Mass., Sept. 16, 1920. **FRANCIS NEWHALL, City Collector.**

Taxes payable at City Hall Hours, 8.30 A. M. to 5 P. M. Saturdays, 8.30 A. M. to 12.30 P. M.

Make Check payable to City of Newton and mail to City Collector, West Newton, Mass.
A self-addressed envelope with remittance will facilitate the return of receipted bill.

A Tax Bill

---

[1] The answer to this question and the questions that follow may be found by pupils by polite inquiries, or from printed reports.

2. The present tax rate for your town is how many mills on each dollar's worth of property? How many cents on each hundred dollars' worth of property? How many dollars on each thousand dollars' worth of property?

3. What is the total assessed value of the property in your community?

4. How much money was raised by taxation last year? For what purposes was this sum spent?

5. How much is paid by your city or town for the support of the county and state governments?

6. If the total property assessment in a town amounts to $10,000,000, what per cent of taxation will be required to raise $100,000? What will this rate be per $100? Per $1000?

7. The taxes collected in a certain city are distributed as follows:

State and county	$0.17	on	$100
Schools	.58	"	"
General Fund	.81	"	"
Sinking Fund	.05	"	"
Police Pensions	.005	"	"
Firemen's Pensions	.005	"	"
Parks and playgrounds	.04	"	"
Miscellaneous	.12	"	"

What was the total tax rate?

8. At a tax rate of $12.40 on $1000, what is the tax on property assessed at $5690?

Find the amount of tax in each of the following cases:

	ASSESSED VALUATION	TAX RATE	POLL TAX
9.	$8000	$16.00 on $1000	$2
10.	$2500	$1.00 on $100	$2
11.	$40,000	$9.00 on $1000	—
12.	$20,000	$1.80 on $100	—

13. The assessed value of the taxable property in a town is $985,340. The rate of taxation is $1.93 per $100. Find the amount of tax to be collected.

14. Find the total amount of James Wilson's taxes: Poll tax, $2; personal property, $270; real estate, $1410.

15. Of a tax of $19.70 per $1000 in a city, $.0365 is paid to the county for the repair of roads. The assessable property of the city is valued at $141,622,660. What amount is contributed by that city for the county roads?

16. Property owners in a city were assessed 4 mills on each $100 for the elevation of railroad tracks. The assessed valuation of property in the city was $185,714,755. What amount was available that year for track elevation?

17. When a city puts in new sewers, it assesses the property owners who are benefited by the sewer. A special assessment for a sewer is at the rate of $.35 per hundred square feet of land, drained. What assessment must be paid by a man who owns two lots, one 60 × 151 ft., the other 60 × 180 ft.?

18. A certain city taxes automobiles at the rate of $8.50 for a small car and twice that amount for a large car. There are 9700 automobiles in the city, of which 8250 are small cars and the rest larger cars. Find the income from this source.

19. The valuation of the assessable real estate in a city is $56,868,850; and of the personal property, $26,739,070. With a tax rate of $18.80 on $1000, how much more than the city budget of $1,518,249 would be raised if the entire tax should be collected?

*20. A man who was paying a tax of $16.90 on $1000, on an assessed valuation of $28,700, moved to a town where the tax rate was only $12.35, but where he was assessed $35,000. In which place did he pay the larger amount of taxes? How much more was his tax in that place?

CHAPTER VIII. USEFUL MEASUREMENTS

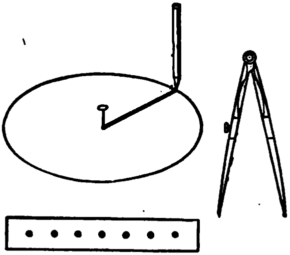
37. Circles

I

A **circle** is a surface bounded by a curved line every point of which is equally distant from a point within called the center.

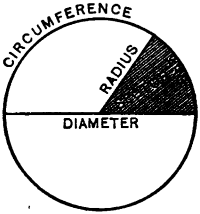
[Use pencil for drawings only.]

1. Explain how to draw the boundaries of a circle with a piece of string. With a strip of punched cardboard. With a pair of compasses.



Drawing a Circle

2. What is meant by the circumference of a circle? By the radius (plural, radii)? By the diameter? By an arc? By a sector?



3. Since there are 360° in a circle, how many degrees are there in a semicircle (half-circle)? In a sector equal to one eighth of a circle?

4. Draw on a blackboard a circle with a radius of 1 ft. What is the length of its diameter?

5. What is the diameter of a circle with a radius of $12\frac{1}{2}$ ft.? With a radius of 4 ft. 9 in.?

6. What is the radius of a circle when the diameter is 18 in.?

7. Find the radius of a circle with a diameter of $8\frac{1}{2}$ in. With a diameter of 5.8 ft. With a diameter of 3 ft. 4 in.

8. What is the diameter of a circle with a radius of 3 ft. 8 in.?

9. Draw to a scale of 1 foot to $\frac{3}{8}$ of an inch a circle with a radius of 3 ft. What is the diameter of your drawing?

*10. Draw to a scale of 1 foot to $\frac{8}{16}$ of an inch a circle with a diameter of 10 ft. What is the radius of the drawing?

II. THE CIRCUMFERENCE OF A CIRCLE

[Without pencil.]

1. With the help of a tape measure, find the distance around an ink bottle, a music roll, a pail, or some other circular object. Divide this distance (the circumference) by the diameter of the object.

By careful measurements and computations, it has been found that the circumference of a circle equals about $3\frac{1}{7}$ times the diameter, or, more exactly, 3.1416.

The number 3.1416, for convenience, is called *pi*, from the Greek letter π (pī).

Since the circumference of a circle equals twice the radius multiplied by 3.1416, this formula may be used:

$$C = 2\pi R$$

In the following problems, whenever it is convenient, give π the value of $3\frac{1}{7}$.

2. Find the circumference of a circular table with a radius of 21 in. Of a mat with a radius of $3\frac{1}{2}$ in. Of a fountain basin with a diameter of 14 ft.

3. What radius should be used by which to mark out a circular flower bed $9\frac{3}{7}$ ft. in circumference?

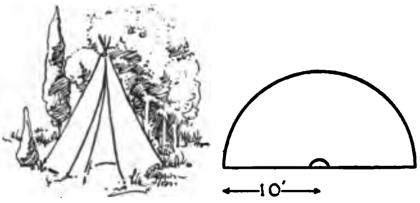
4. What radius should be used for a semicircle having for the length of its curved edge $3\frac{1}{7}$ ft.?

[With pencil.]

5. An automobile wheel $23\frac{1}{2}$ in. in diameter covers what distance each time it makes a complete revolution?

6. Find the radius by which to draw a circle 44 ft. in circumference.

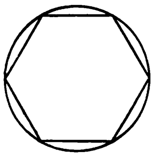
7. A semicircle with a radius of 10 ft. is drawn on a sheet of canvas and used for a camping tepee, or wigwam. What is the circumference of the base of the tepee when it is finished and set up?



Wigwam and Pattern

8. If a camping tepee with a circumference at the base of 25 ft. were desired, what radius should be used in drawing the semicircle?

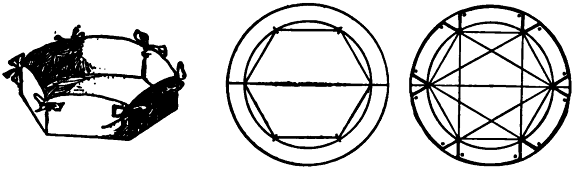
9. Draw a circle and inscribe, within its circumference, lines equal in length to its radius. Into how many equal parts is the circumference divided? How many sides has the figure inscribed within the circle?



Hexagon

A six-sided figure is called a **hexagon**.

10. Give directions for drawing, with the help of a circle, a hexagon with equal sides.



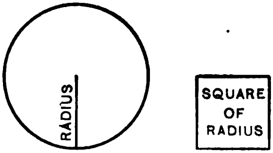
(1) (2)

Hexagonal Box and Pattern

11. To make an hexagonal box like the one pictured here, draw on cardboard from one point taken as a center, first a circle with a radius of 3 inches and then one with a radius of 6 inches. Inscribe within the smaller circle a hexagon with equal sides. (See figure 1.) Draw three pairs of parallel lines at right angles to the sides of the hexagon. (See figure 2.) Cut on the lines made heavy in figure 2, and fold on the lines forming the perimeter of the hexagon. Finish the box.

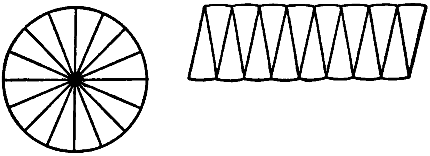
III. Area of a Circle

[Use pencil only when needed.]



1. Make a rough estimate of the number of times the square of the radius can be fitted into this circle.

2. Think of the circle as divided into many small triangles and these triangles re-arranged to form a rectangle with the altitude equal to the radius of the circle. With the help of this device, see if you can estimate more exactly the number of times the square of the radius can be fitted into the circle.



By careful measurements and computations, it has been found that the square of the radius can be fitted into a circle about $3\frac{1}{7}$ times, or, more exactly, 3.1416 times.

To find the area of a circle, multiply the square of the radius by π.

The square of a number is found by multiplying the number by itself. To indicate that a number is to be squared, a small figure 2 is written at the right and slightly above the number to be squared: 4^2 indicates that 4 is to be squared. The expression πR^2 indicates that the radius of a circle is to be squared and then multiplied by π.

The area of a circle = πR^2.

3. Give π the value of $3\frac{1}{7}$ and find the area of a circle with a radius of 7 in. With a radius of 14 ft.

4. Give π the value of 3.1416 and find the area in square feet of a circle with a radius of 10 in.

5. A round house in the switching yards of a railroad covers a circle with a radius of 30 ft. What is the area covered?

6. A concrete basin for a playground wading pool is made with a circular flat bottom with a radius of 10 ft. How many square yards does the bottom of the basin cover?

*7. How many more square yards are there in a circle with a radius of 12 ft. than in one with a radius of 9 ft.?

*8. A concrete walk is built around a park fountain. The radius of the basin of the fountain is 7 ft.; the width of the walk, 3½ ft. Find the cost of building the walk at 75¢ a square yard.

IV

[With pencil.]

Find the circumference and the area of circles whose dimensions are the following:

1. Diameter 7 feet.
2. Radius 9 inches.
3. Diameter 12 feet.
4. Radius 2½ feet.
5. Diameter 3½ feet.
6. Radius 1 ft. 9 in.
7. Diameter 2 ft. 4 in.
8. Radius 3 ft. 6 in.
9. Diameter 4 ft. 8 in.
10. Radius 5 ft. 3 in.

11. How much greater is the area of a circular phonograph record with a diameter of 12 inches than one with a diameter of 9 inches? What is the difference in the length of their circumferences?

*12. What is the diameter of the largest circle that can be cut from a square piece of cloth 18 inches on a side? (Make a diagram.) What surface will it cover?

*13. A semicircular transom across the top of a doorway 2 ft. 9 in. wide contains how many square inches?

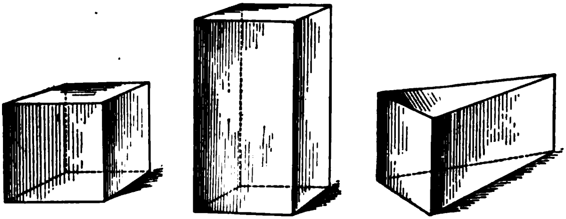
*14. Which has the greater area and how much, a circle with a diameter of 1 ft. 3 in. or a rectangle 2 ft. 6 in. long and 2 ft. wide?

*15. Which has the greater area and how much, a circle with a radius of 8 inches or a triangle with a base of 3 ft. 4 in. and altitude of 2 ft. 6 in.?

*16. Select five articles in your home that have circular tops or bases, measure the diameters, and figure out the area and circumference.

38. Finding the Contents, or Volume, of Boxes, Bins, and other Solids

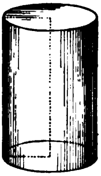
I. PRISMS AND CYLINDERS



Prisms

A solid bounded by two opposite equal and parallel surfaces and by parallelograms is called a **prism**.

Examples of prisms are boxes, bins, bricks, and rooms. Can you give other examples?



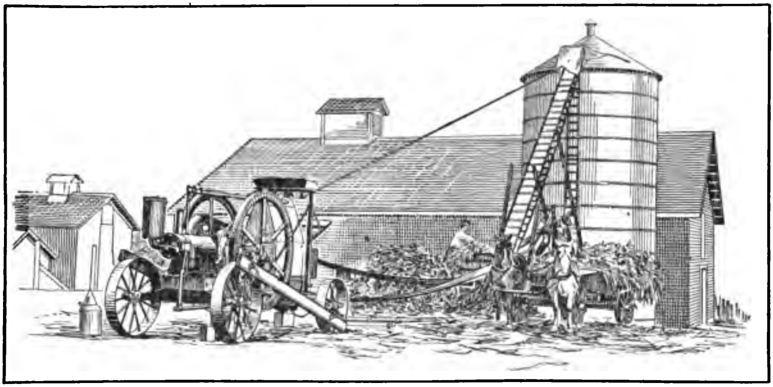
Cylinder

A solid that may be imagined to be cut out by rotating a rectangle about one of its sides is called a **cylinder**.

The two equal and parallel surfaces of a prism or a cylinder are called the **bases**, and the perpendicular distance between them is called the **altitude**.

II. FINDING THE VOLUME, OR CONTENTS, OF PRISMS AND CYLINDERS

You will recall that to find the contents or volume of a box, we multiply the area of the base by the height, or altitude. The contents or volume of any prism or cylinder is found similarly.



Cylindrical Silo

The volume or contents of a prism or a cylinder is equal to the area of one of the bases multiplied by the altitude.

[Use pencil only when needed.]

Find the volume of these prisms:

1. Area of base, 12 sq. ft.; altitude, 6½ ft.

2. Area of base, 17.5 sq. in.; altitude, 12 in.

3. Length of rectangular base, 14 in.; width, 6 in.; altitude of prism, 5 in.

4. What is the contents of a cylinder whose radius is 10 ft. and whose altitude is 6 ft.? (Area of base = 3.1416 × the square of the radius.)

5. Given a cylinder with radius, 8 in., and altitude, 10 in.; find its volume.

[With pencil.]

6. Twelve cubic feet of air weigh a pound. Find the weight of the air in your schoolroom.

7. How much water is there in a cistern whose diameter is 8 ft., when the depth of water is 12 ft. 9 in.? How many gallons of water does it contain? (1 gallon = 231 cu. in.)

8. At 150 lb. to the cubic foot, find the weight of a rectangular paving stone with these dimensions: 3¾ ft. by 4½ ft. by 5 in.

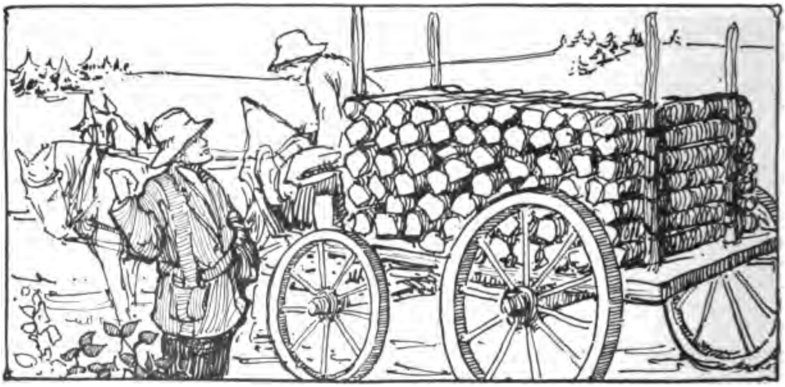
9. A bushel contains 2150½ cu. in. How many bushels of oats can be put into a bin whose base measures 6 ft. by 4½ ft., and whose altitude is 5¼ ft.?

10. What is the capacity of a gas tank whose diameter is 70 ft., and whose altitude is 45 ft. 9 in.?

*11. If a cubic foot of silage weighs 35 lb., how many tons of silage can be put into a silo 20 ft. deep, the area of whose base is 600 sq. ft.? If each cow eats 40 lb. of silage a day, how long will the silage last a herd of 45 cows?

*12. Measure a prism or a cylinder at home. Make and solve a problem based on your measurements.

III. WOOD MEASURE



A Cord of Wood

A pile of wood, 8 ft. long, 4 ft. wide, and 4 ft. high (128 cu. ft.) is called a **cord**.

[With pencil.]

1. How many cords of wood can be piled into a shed, 18 ft. long, 8 ft. wide, and 10 ft. high?

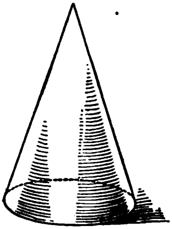
2. Mr. Peterson cut 17 cords of wood from his woodland. He paid \$3.25 a cord for having it sawed and split, and sold it at \$2.50 for a quarter-cord. How much did he make on the wood?

*3. Make and solve five other problems about cords of wood. Use local prices.

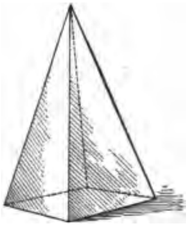
IV. Cones and Pyramids

A solid having a circle as a base and a convex surface tapering uniformly to a point is called a **cone**.

A solid whose base is a polygon and whose sides are triangles terminating in a common point is called a **pyramid**.



Cone



Pyramid

Give examples of objects that you have seen that are cones or pyramids.

V. Finding the Volume of Cones and Pyramids

If you should make a hollow cone and a hollow cylinder with the same base and the same altitude, you would find that you could exactly fill the cylinder by emptying the cone, filled with sand, into the cylinder three times. The cone holds one third as much as the cylinder.

Similarly, we find that a pyramid holds one third as much as a prism having the same base and altitude.

Since the volume of a cylinder or a prism is equal to the product of the area of the base and the altitude, we conclude that

The volume of a cone or a pyramid is equal to one third the product of the area of the base and the altitude.

[Use pencil only when necessary.]

1. What is the volume of a cone the diameter of whose base is 6 ft. and whose altitude is 7 ft.?

2. Given the area of the base of a pyramid, 250 sq. in., and the altitude, 36 in., find its volume.

3. Find the volume of a pile of sand in the shape of a cone, the area of whose base is 216 sq. ft. and whose height measures 5 ft. 4 in.

4. To gain an idea of the immensity of the pyramid of Cheops in Egypt, find its volume. Its square base is 746 feet on a side, and its height is 480 ft.

*5. Measure some object having the shape of a cone or a pyramid; then make and solve a problem based on your measurements.

39. Measuring Heat Expansion

1. Why does a blacksmith heat a new tire that he wishes to fit on to a wheel?

2. Why are spaces left between the ends of railroad rails?

3. What happens to the mercury column in a thermometer when the air is very warm? Put your hand on the bulb of a thermometer and observe the result.

About 200 years ago, a man named Fahrenheit invented the thermometer. He put a small tube, marked off into equal spaces, called degrees, which he had filled with mercury, into melting ice and marked the height of the mercury column, 32°, as the freezing point. Then he put it into boiling water and marked the height of the mercury column, 212°, as the boiling point.

[Without pencil.]

4. How many degrees are there between the boiling point and the freezing point of water?

We use the sign (+) to indicate a number of degrees "above zero," and the sign (−) to indicate a number of degrees "below zero."

In the following readings, give the rise or fall in temperature:

5. +33° to −3°.

6. +16° to −8°.

7. −12° to −3°.

8. +20° to +80°.

9. −17° to −6½°.

10. +15° to −17°.

11. +32° to +105°.

12. +34° to −7°.

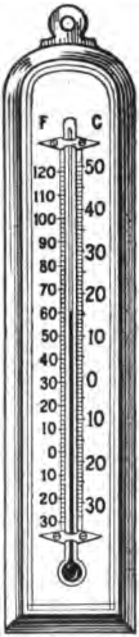
13. −4° to +22°.

14. The readings for four successive days were as follows: −4°; −2°; −5°; −6°. Give the average temperature for the four readings.

The Centigrade[1] thermometer is commonly used in scientific work. The freezing point (32° F) on this thermometer is marked zero; and the boiling point (212° F), 100 degrees. Degrees below the freezing point are indicated by the minus (−) sign.

Since 100° C = 180° F (212° − 32° = 180°), to change Fahrenheit degrees to Centigrade, subtract 32° (since 32° F is 0° C) and multiply by $\frac{5}{9}$ ($\frac{100}{180}$).

To change Centigrade degrees to Fahrenheit, multiply by $\frac{9}{5}$ ($\frac{180}{100}$) and add 32°.



[Use pencil only when needed.]

15. 1° C is how many degrees Fahrenheit?

$$(1° \times \tfrac{9}{5}) + 32° = \text{—}\ °\text{ F.}$$

16. Change 122° F to Centigrade.

17. Change 212° F to Centigrade.

18. Change 50° C to Fahrenheit.

19. Change 60° C to Fahrenheit.

20. The temperature of a liquid is 73° C. How many degrees Fahrenheit is this?

*21. Make a graph on the blackboard, showing the temperature in Centigrade degrees, each day at a given hour for a week.

*22. A piece of steel will expand .0012 times its length when heated from 32° F to 212° F. If a railway track is laid when the temperature is 75° F, how much space must be left between the ends of the 40-foot rails so that the ends will not touch until the thermometer rises to 110°? How far apart will the ends be at zero?

---

[1] *Centigrade* means *one hundred degrees.*

How many degrees is the rise from 32° to 212°? If steel expands .0012 times its length for this number of degrees, how many times its length will it expand in a rise of 1°? (Carry this answer 6 decimal places and then drop the remainder.)

How many degrees is the difference in temperature between 75° and 110°?

How many times its length will steel expand in a change of this number of degrees? The answer to the last question multiplied by 40 will give the expansion of a 40-foot rail. This is the distance apart that the ends must be laid. Express your final result in inches.

When the temperature falls from 75° to zero, the rail will shrink 75 times its expansion for 1° change in temperature. A 40-foot rail will shrink how much? The distance apart at zero will be the shrinkage plus the distance apart that the rails were laid in the first place.

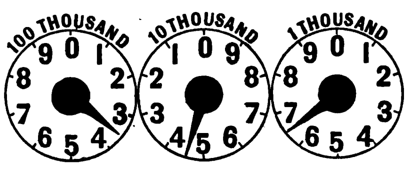
*23. Copper expands .0018 times its length from 32° F to 212° F. How much longer is a copper transcontinental telegraph wire at 100° than at zero, the distance across the continent being regarded as 3000 miles?

40. Measuring Gas and Electricity

I. Gas

Illuminating and cooking gas is measured by gas meters placed by the gas company on the premises of the family using the gas. The meter is read usually once a month by an employee of the company, who reports the reading of the meter. The difference between this reading and that of the previous month will show the amount of gas used.

Directions for Reading Gas Meters



Each division on the right-hand circle denotes 100 cu. ft.; on the center circle, 1000 cu. ft.; and on the left-hand circle, 10,000 cu. ft.

Read from left-hand dials to right, always taking the figures which the hands have passed and adding two ciphers for the hundreds. The dials above, reading 3, 4, and 6, show 34,600 feet registered. To find the amount of gas used in a given time, deduct the previous register (the reading on the last gas bill) from the present; viz.:

REGISTER BY ABOVE DIALS	34,600
REGISTER BY PREVIOUS STATEMENT	29,100
GIVEN NUMBER OF FEET REGISTERED	5,500

The gas meter is read similarly to other meters; so, by learning to read the gas meter, one can quickly learn to read meters for electric current, water, automobiles, steam, air, etc.

[With pencil.]

1. At 90¢ per 1000 ft., how much would a gas bill amount to in the case described above?

2. The next time the meter reader called, he found the reading of the meter to be 39,400 ft. Between what two numbers did the pointer on each dial stand when he read the meter?

3. How many feet of gas had been used since the previous reading (shown by the hands on the dial illustrated on page 232)?

4. How much did the next gas bill come to at 90¢ per 1000 ft.?

5. Find the number of cubic feet of gas used between two readings when the first reading is 43,000 cu. ft. and the second reading is 47,400 cu. ft. When the first is 54,500 and the second 62,400.

Tell where the pointer on each dial would stand to read:

6. 1800 cu. ft. of gas.

7. 44,000 cu. ft. of gas.

8. 23,700 cu. ft. of gas.

9. 95,600 cu. ft. of gas.

10. What is the largest amount of gas that can be registered on the right-hand dial? On the middle dial? On the left-hand dial?

*11. If you have a gas meter at home, bring a diagram to class, showing how each dial stood when you took the reading; and by referring to the last bill sent your parents, tell how many cubic feet of gas were registered since the last bill.

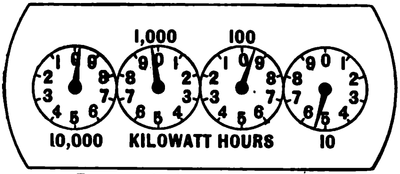
II. Electricity

Electric energy is measured in **watts** and **kilowatts.**[1]

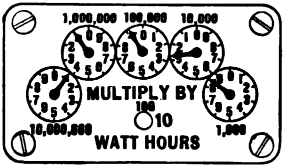
1000 watts (W) = 1 kilowatt (K.W.)

The following directions for reading the electric meter are sent out by an Electric Light Company. See how much of these directions you can understand:

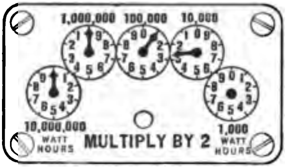
How to Read the Electric Meter



Reading 9995 Kilowatt Hours



Reading 10928 x 10 = 109280 K.W.Hrs.



Reading 12 x 2 = 24 K.W.Hrs.

The meter records the amount of electrical energy passing through it in **kilowatt hours** (the unit of electrical measurement, equal to the use of 1 kilowatt for an hour). The cuts here represent the various styles of registering dials on electric meters. Each division on the first right-hand dial carrying a hand represents one kilowatt hour, or unit. Starting with this dial, read each dial to the left in succession, placing the figures in the same order as read, being sure to take those figures which the hand has passed. If in doubt whether a hand has actually passed a figure, note whether or not the next hand to the right has just passed zero, remembering that no hand has completed a division until the hand next to the right has completed a revolution. The relation between all hands is 10 to 1; that is, one complete revolution of one hand indicates one division on the next hand to the left.

For uniformity, the dials of all meters (of the same style) are the same without regard to capacity, so that in some sizes a multiplying factor called a constant becomes necessary. This constant is definitely established by the manufacturer of the meter and is plainly indicated on the dial as "Multiply by —." (See figures 2 and 3 above.) If two such constants appear on the dial, always use the lesser one; if there is none, then the dial is "direct reading." To determine the number of kilowatt hours, or units, used, deduct the previous meter reading from the present meter reading and multiply the difference by the "constant," if any.

---

[1] Pronounced kĭl′ŏ-wŏt.

[Use pencil only when needed.]

1. If there is an electric meter in your school building, read it.

2. At 10¢ per kilowatt hour, how much would be the bill for 12.7 kilowatt hours of electric current used in a house during a month?

3. Factories, hotels, and other institutions that use a large amount of electric current are usually given a proportionately lower rate. A factory used for power and lighting 423.8 kilowatt hours in one week. Find the cost at 6¢ per kilowatt hour.

4. A family used 197.4 kilowatt hours during a year. How much did it cost them at 10¢ a kilowatt hour?

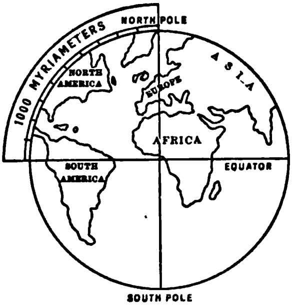
5. After putting in a washing machine, run by an electric motor, this family (problem 4) found that its bill for electricity increased 12% on the average. How much did this increase amount to in a year?

6. In a village where the electric current is brought from a distant city, the rate is 15¢ per kilowatt hour. What would be the monthly bill for electricity of a family that used 18.5 kilowatt hours in a month?

7. In a city situated near a river, the falls of which are used to generate electricity, the usual rate for electric current is 8¢ per kilowatt hour, and the rate to factories runs as low as 3¢ per kilowatt hour. At these rates, what would be the cost of electricity to a man for a year in which he uses 12,347 kilowatt hours in his factory and 345.8 kilowatt hours in his home?

*8. Find the local rate for electric current and make and solve three problems based on it. Include in your problems, if possible, the actual number of kilowatt hours used by some family or hotel or factory during a month or a year.

41. Metric System



Measuring a Meter on the Earth's Surface

The **metric system** of weights and measures is used in European countries and, to a limited extent, in this country, especially in scientific work.

It is based on the **meter**, which was intended to be $\frac{1}{10,000,000}$ of the distance from the equator to each of the poles, but which was later found to be slightly less than that measure. It is equivalent to 39.37 inches.

The meter when divided into tenths, hundredths, and thousandths gives lower denominations, and when expressed in multiples of ten gives higher denominations.

LINEAR MEASURE

10 millimeters (mm.) = 1 centimeter (cm.)
10 centimeters = 1 decimeter (dm.)
10 decimeters = 1 meter (m.)
10 meters = 1 dekameter (Dm.)
10 dekameters = 1 hektometer (Hm.)
10 hektometers = 1 kilometer (Km.)
10 kilometers = 1 myriameter (Mm.)

Note that:

milli means .001.
centi means .01.
deci means .1.
deka means 10.
hekto means 100.
kilo means 1000.
myria means 10,000.

[Without pencil.]

1. Give and define other words in which these prefixes occur, such as *millennium, century, decimal, decalogue, hektograph, kilowatt, myriad.*

2. Show that, in the table on page 236, reduction to a lower denomination is made by moving the decimal point to the right, and to a higher denomination by moving the point to the left.

Change to the next lower denomination:

3. 4 meters
4. 25 kilometers
5. .7 decimeters
6. 1.4 Mm.
7. 234 cm.
8. .96 Dm.
9. 4½ m.
10. .75 Km.
11. 3.25 dm.

Change to meters or decimals of a meter:

12. 42 dm.
13. 3 Km.
14. 7 Hm. 2 Dm.
15. 3.5 Mm.
16. .075 dm.
17. 3000 cm.

[With pencil.]

18. How many feet in 1 dm.? In 1 Dm.?

19. Draw on the blackboard a line 2 m. in length.

20. Express in meters the height of your schoolroom door.

21. The distance from Paris to Calais is 295.3 Km. How many miles is it?

SQUARE MEASURE

100 square millimeters = 1 square centimeter
100 square centimeters = 1 square decimeter
100 square decimeters = 1 square meter
100 square meters = 1 square dekameter
100 square dekameters = 1 square hektometer
100 square hektometers = 1 square kilometer

In measuring land, the square dekameter is called an **are**, and the square hektometer, a **hektare** (**Ha.**).

CUBIC MEASURE

1000 cubic millimeters = 1 cubic centimeter

22. Complete the table.

In measuring wood, the cubic meter is called a **stere**.

MEASURES OF CAPACITY

The basal unit of capacity is the **liter** (pronounced lee′ter), which is equal to 1 cubic decimeter. A liter is equivalent to 1.06 qt. liquid measure or .91 qt. dry measure.

10 milliliters (ml.) = 1 centiliter (cl.)
10 centiliters = 1 deciliter (dl.)
10 deciliters = 1 liter (l.)
10 liters = 1 dekaliter (Dl.)
10 dekaliters = 1 hektoliter (Hl.)

MEASURE OF WEIGHT

The basal unit of weight is the **gram**, which is the weight of one tenth of a liter (1 cubic centimeter) of pure water at a given temperature. The kilogram is equivalent to 2.2 lb.

10 centigrams = 1 decigram (dg.)
10 decigrams = 1 gram (g.)
10 grams = 1 dekogram (Dg.)
10 dekograms = 1 hektogram (Hg.)
10 hektograms = 1 kilogram (Kg.)
10 kilograms = 1 myriagram (Mg.)
10 myriagrams = 1 quintal (Q.)
10 quintals = 1 metric ton (M.T.)

EQUIVALENTS TO REMEMBER

1 m. = 39.37 in., or 40 in. (approximately)
1 Km. = .62 mi. or $\frac{5}{8}$ mi. (approximately)
1 Ha. = 2.47 acres or $2\frac{1}{2}$ acres (approximately)
1 l. = .91 qt. (dry); 1.06 qt. (liquid)
1 Hl. = 2.84 bu.
1 Kg. = 2.2 lb.
1 M.T. = 1.1 T.

[Without pencil.]

23. Explain the meaning of these prefixes: *deci*, *deka*, *milli*, *hecto*, *centi*, *kilo*, *myria*.

24. Write the metric table for linear measure, with equivalents in English measures.

[With pencil.]

Change these measures as indicated:

25. 4 Hl. to l.
26. 25 dg. to g.
27. 340 Kg. to M.T.
28. 500 ares to Ha.
29. 1850 dm. to Dm.
30. .45 m. to cm.
31. $\frac{3}{8}$ sq. Km. to sq. m.
32. 40.9 M.T. to Hg.
33. 645.15 cu. m. to cu. cm.

Change to English weights and measures:

34. 42 m.
35. 25 M.T.
36. 7 Hl.
37. 400 Ha.
38. 10,000 Km.
39. $18\frac{3}{4}$ l.
40. 179 Kg.
41. 4.75 dm.
42. $96\frac{2}{3}$ Km.

Change to metric equivalents:

43. 25 miles.
44. 4 tons.
45. 20 acres.
46. 3 yd. 8 in.
47. 13 gal.
48. 1 bbl. ($2\frac{1}{2}$ bu.)
49. 45 cu. ft.
50. 10 lb. 7 oz.
51. 42.65 sq. rd.

52. Harold received a letter from his cousin in France, saying that he had just taken a walk of 8 Km. How many miles was that?

53. A boy's lung capacity increases from 1000 cu. cm. at 6 years of age to 3600 cu. cm. at 18 years of age. Express the difference in cubic inches. (See page 318.)

54. The average weight of a girl at 13 to 14 years of age is 37.7 Kg. How many pounds is this?

*55. Express your height and weight in metric measures.

*56. A rectangular tank has a capacity of 300 l. What dimensions might such a tank have?

CHAPTER IX. POWERS AND ROOTS

42. Powers

What is the area of a square measuring 5 ft. on a side? 7 ft.? 9 ft.? 20 ft.?

Multiplying a number by itself gives the **square** of the number. The square of a number may be indicated by a small 2 placed to the right of the number.

5^2 is read 5 square. $5^2 = 25$.
6^2 is read 6 square. $6^2 = 36$.

[Use pencil only when needed.]

1. $4^2 = ?$
2. $8^2 = ?$
3. $10^2 = ?$
4. $7^2 = ?$
5. $12^2 = ?$
6. $14^2 = ?$
7. $15^2 = ?$
8. $24^2 = ?$
9. $78^2 = ?$
10. $147^2 = ?$
11. $(1\frac{1}{2})^2 = ?$
12. $3.25^2 = ?$
13. $.0475^2 = ?$
14. $17.48^2 = ?$
15. $(3\frac{9}{16})^2 = ?$

5^2, or 25, is said to be the second **power** of 5.
5^3, $(5 \times 5 \times 5)$, or 125, is the third power of 5.
2^4, $(2 \times 2 \times 2 \times 2)$, or 16, is the fourth power of 2.

The power of a number is the product found by taking the number as a factor a given number of times.

Give answers:

16. $3^2 = ?$
17. $3^3 = ?$
18. $3^4 = ?$
19. $3^5 = ?$
20. $3^6 = ?$
21. $7^3 = ?$
22. $10^4 = ?$
23. $12^3 = ?$
24. $19^2 = ?$
25. $20^4 = ?$
26. $181^2 = ?$
27. $89^3 = ?$
28. $.25^3 = ?$
29. $(\frac{3}{4})^5 = ?$
30. $(1\frac{7}{8})^4 = ?$

43. Square Root

1. If the area of a field is 25 sq. rd., what is the dimension on each side?

When we find the factor that has been multiplied by itself to give a number, we are said to **extract the square root** of the number.

The square root of 25 is 5. Of 49 is 7. Of 100 is —?

Extract the square root of: [Without pencil.]

2. 4
3. 36
4. 81
5. 121
6. 144
7. 1
8. $\frac{1}{4}$
9. $\frac{4}{9}$
10. .25

11. Give the dimension of each side of a square containing 64 sq. in. Of one containing 1 sq. mi. Of one containing $\frac{1}{9}$ sq. yd.

It is sometimes convenient to know how to extract the square root of a number when this cannot be done by inspection.

Extract the square root of 1764.

Find the factors of 1764.

$$\begin{array}{r|l} 2 & \underline{1764} \\ 2 & \underline{882} \\ 3 & \underline{441} \\ 7 & \underline{147} \\ 3 & \underline{21} \\ & 7. \end{array}$$

Since each factor appears twice,

$$(2 \times 3 \times 7)^2 = 1764.$$

$$(42)^2 = 1764.$$

The square root of 1764 is 42.

Extract the square root of: [With pencil.]

12. 256.
13. 324.
14. 576.
15. 1089.
16. 1225.
17. 1600.
18. 2304.
19. 2704.
20. 2916.
21. 3600.
22. 2601.
23. 1444.

When a number whose square root is to be found cannot readily be factored, the following method may be used:

(1) Extract the square root of 3481.

```
      5  9
    ------
    34ˇ81
    25
109 | 9 81
    | 9 81
```

(1) Beginning at the right, separate the number into periods of two digits each.

(2) Find the largest square (25) in the first period to the left. Write the square root (5) of this square in the quotient over the period. Subtract 25 from 34, and annex to the remainder (9) the next period (81).

(3) Form a new partial divisor to the left of the new dividend (981) by taking twice the root thus far found (5). Annex to this partial divisor (10) a number (9) that shows the number of times the partial divisor (10) is contained in the first two figures (98) of the new dividend. Place this number (9) in the quotient over its period. Multiply the new divisor (109) by the new figure in the quotient (9). If the resulting product is larger than the last new dividend, substitute for the last figure placed in the quotient, the next smaller number. Subtract the product from the new dividend.

(4) Continue until all the periods have been used.

The square root of 3481 is 59.

(2) Extract the square root of 24 to two decimal places.

```
      4. 8  9
    ----------
    ˇ24.ˇ00ˇ00
     16
88  | 800
    | 704
969 | 9600
    | 8721
```

Since there are to be 2 decimal places in the root, annex four ciphers to the number after the decimal point.

Proceeding as before, we find the square root to be 4.89 +.

In extracting the square root of decimals, point off periods of two digits both to the right and to the left of the decimal point.

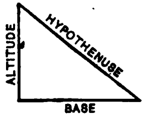
[With pencil.]

Extract the square root. If the root is not a whole number, carry to two decimal places.

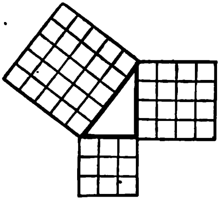
24. 1521.
25. 1849.
26. 3481.
27. 2809.
28. 7.29.
29. 11.65.
30. 39.
31. 110.
32. .1231.
33. 4.2875.
34. 1225.2601.
35. 73.4936.

44. Finding the Hypotenuse of a Triangle

The longest side of a right-angled triangle is called the hypotenuse. What is each of the other two sides called?



In the center of a large sheet of paper draw a triangle whose altitude and base are 2 in. and 1½ in. respectively, and whose included angle is a right angle. Divide the three sides into half-inch segments. Upon each side of the triangle draw squares. Divide each of these squares into ½-inch squares. Compare the area of the square upon the hypotenuse with the sum of the areas of the other two squares.



The square of the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides.

[Use pencil only when needed.]

1. Draw a triangle with an altitude of 3 in. and a base of 4 in., with the included angle a right angle. What kind of triangle is it? What is the sum of the squares of the altitude and base? What then must be the square of the hypotenuse? How long must the hypotenuse be? Measure to see if your answer is correct.

2. Draw a right-angled triangle with sides 6 in. and 8 in. respectively. How long should the hypotenuse be? Why? Draw the hypotenuse and measure it to check your answer.

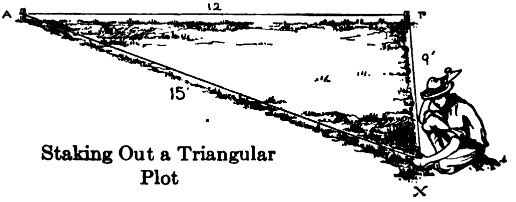
3. What is the length of the hypotenuse of a triangle whose base is 12 ft. and whose altitude is 9 ft.?

4. How long must a rope be to reach from the top of an upright pole 30 ft. high, to a point on the ground 40 ft. from its foot?

5. Two adjoining sides of a rectangular field are 12 rd. and 16 rd. respectively. A path runs from one corner to the opposite

corner. How many feet are saved by using the path instead of the sidewalk around the field?

6. The boy in the picture is getting a right angle at *P* for the corner of a shack. He drives stakes at *A* and *P* on a line 12 ft. apart. He then fastens one end of a 15-ft. line at *A* and one end of a 9-ft. line at *P*. Drawing the loose ends of the two lines taut, he drives a stake at *X*, where they meet. Prove that the angle *APX* is a right angle.



Staking Out a Triangular Plot

7. If the boy had laid off *AP* as 4 ft. and used a 3-ft. line for *PX*, what length of line should he use for *AX* to get a right angle?

*8. Prove that the following method is correct in making a right angle at *P*: Lay off *AX* as 25 ft. Fasten one end of a 35-ft. tape at *A* and the other end at *X*. With the third stake at the 20-ft. mark on the tape, draw the tape taut and drive the stake at *P*. The angle *APX* is a right angle.

CHAPTER X. RATIO AND PROPORTION

45. Ratio

1. A boy's or a girl's education, including a college course, usually requires 16 years. What part of this time is spent in the elementary school? In the high school?

2. What is the relation of 8 to 16? Of 4 to 16?

The expression of the relation of two quantities is called a **ratio.**

The two quantities compared are called the **terms** of the ratio.

In the ratio 8 to 16, 8 is the first term and 16 is the second term.

A ratio may be expressed in three ways: by the sign of division (8 ÷ 16); by a fraction ($\frac{8}{16}$); or by a colon (8 : 16).

The value of a ratio is found by dividing the first term by the second term. If the answer is a fraction, it is reduced to its lowest terms. As in any comparison, the two terms of a ratio must be of the same denomination before the relation between them can be found.

What is the ratio of 2 yd. to 4 ft.?

2 yd. = 6 ft.
6 ft. : 4 ft. = 6 : 4 = $\frac{6}{4}$ = $\frac{3}{2}$ = $1\frac{1}{2}$.
The ratio of 2 yd. to 4 ft. is $1\frac{1}{2}$.
2 yd. = $1\frac{1}{2}$ times 4 ft.

Find the ratio of: [Without pencil.]

3. 5 : 10.
4. 10 : 5.
5. 4 : 3.
6. 3 : 4.
7. $\frac{1}{2}$: 2.
8. 2 : $\frac{1}{2}$.
9. 5 : .25.
10. .25 : .5.
11. $3\frac{1}{2}$: $10\frac{1}{2}$.
12. .25 : 100.
13. 3 yd. : 1 ft.
14. 12 qt. : 1 pk.
15. 4 in. : 2 yd.
16. 10 hr. : 1 day.
17. 2 lb. : 12 oz.

18. Give and find the value of ten other ratios.

[With pencil.]

19. $3\frac{1}{2}$ lb. of bananas contain as much nourishment as 10 lb. of cabbage. Express in two ways the ratio of nourishment in these two foods.

20. It requires 9 lb. of cucumbers to furnish as much nourishment as $\frac{1}{2}$ lb. of beef. What is the ratio of the amount of nourishment in cucumbers to that in beef?

21. The average weight for boys at $13\frac{1}{2}$ years of age is 84.8 lb.; for girls at the same age, 88.7 lb. Express as a decimal of two places the ratio between these two weights.

22. The average weight for boys $16\frac{1}{2}$ years of age is 121 lb.; for girls of the same age, 112.3 lb. Find the value of the ratio between these weights.

23. 162,520 school children out of 266,426 examined at one time in New York city were found to have defective teeth. Express decimally the ratio between the children having sound teeth to those having defective teeth.

***24.** A rectangular field 24 rd. long contains 3 acres. What is the ratio of the width of the field to its length?

46. Proportion

A boy is paid 80¢ for 4 hours' work. At that rate, how much should he receive for 8 hours' work?

Since the ratio of 8 hours to 4 hours is 8:4, or 2, the boy should receive twice 80¢, or $1.60, for 8 hours' work.

The ratios 8:4 and 160:80 are equal. $8:4 = 160:80$. Likewise, $4:8 = 80:160$.

An equality of two or more ratios is called a **proportion.**

The two outside terms of a proportion are called the **extremes,** and the two inner terms are called the **means.** In the proportion, $8 : 4 = 160 : 80$, 8 and 80 are the extremes, and 4 and 160 are the means.

In a proportion, the product of the extremes is equal to the product of the means.

$$8 \times 80 = 4 \times 160.$$

If one of the extremes in a proportion is missing, it can be found by dividing the product of the means by the extreme given. Likewise, if one of the means is missing, it can be found by dividing the product of the extremes by the given mean.

In the proportion, $2 : 6 = 16 : x$, find x, the missing term.

$\frac{6 \times 16}{2} = x$. Canceling, $\frac{\overset{3}{\cancel{6}} \times 16}{\cancel{2}} = 48$. $x = 48$. | Proof: $2 : 6 = 16 : 48$.
$2 \times 48 = 6 \times 16$.

Find the missing term: [With pencil.]

1. $4 : 6 = 7 : x$.
2. $12 : x = 48 : 16$.
3. $x : 15 = 39 : 108$.
4. $3\frac{1}{7} : 22 = x : 126$.
5. $4.5 : 20.25 = 18 : x$.
6. $4\frac{1}{3} : 12\frac{5}{6} = 7\frac{2}{3} : x$.
7. $5.16 : 3.8 = 21.4 : x$.
8. $42.375 : 5\frac{1}{4} = 12 : x$.
9. $72 : 264 = 349 : x$.
10. $319.7 : 742 = 3.24 : x$.

11. When 8 lb. of sugar are selling for $1.00, how much should be charged for 50 lb.?

12. Two boys sawed and chopped a pile of wood. One of the boys worked 12 hours and was paid $1.50. How much should the other boy, who worked 15 hours, receive at the same rate?

13. How much should be paid for ¾ of a ton of hay, when 6 tons cost $125?

14. A herd of cattle, when fed 5 qt. of grain per day each, use 30 bu. a week. How many bushels would be required per week, if each of the cattle received only 4 qt. per day?

15. Land sold at the rate of $1900 for 12 acres would cost how much for $75\frac{3}{5}$ acres?

16. A tax rate of $16.50 produced an income of $67,980 for a city. How much income would a tax rate of $17 yield?

17. A certain sum of money yields annually $28 when on interest at 4%. How much interest would be received each year if the rate is increased to $4\frac{1}{2}$%?

18. A bushel of shelled corn weighs 56 lb. How many ounces do 3 pints weigh?

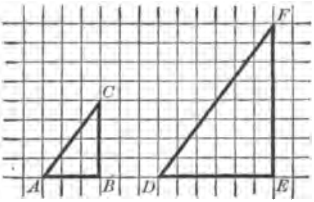
*19. An express train makes the run from New York to Boston, a distance of 229 mi., in 5 hr. 10 min. How long does it take to go from New York to New Haven, a distance of 72 mi., traveling at the same rate?

*20. The record of a herd of 24 cows showed a yield of 3250 lb. of milk per week. How much milk would be produced per week if 10 cows of the same average capacity should be added to the herd?

47. Similar Triangles

Triangles whose corresponding sides have the same ratio are called **similar triangles**.

These two triangles are similar because the side *AB* of the small triangle bears the same relation to the side *DE*, the corresponding side of the large triangle, that *CB* bears to *FE*. What is the ratio of *AB* to *DE*? *CB* to *FE*? Observe that the corresponding angles of these triangles are equal.



Similar Triangles

Suppose that the length of *FE* were unknown, but that the length of *AB* (3 units), the length of *CB* (4 units), and the length of *DE* (6 units) were known. Then, from the following proportion, the length of *FE* could be found:

Let x = length of *FE*.

$3 : 4 = 6 : x.$

x = 8 units, the length of *FE*.

[With pencil.]

1. Two sides of a triangle, *AB* and *BC*, are 5 ft. and 8 ft. respectively. A similar triangle has a side *AB*, 15 ft. long. How long is its side *BC*?

2. One side of a triangle is $2\frac{1}{2}$ in.; the corresponding side of a similar triangle is 5 in. Another side of the first triangle is $7\frac{1}{2}$ in. What is the corresponding side of the second triangle?

3. Some boys and girls staked off a line 200 ft. long on the bank of the Hudson River. They measured the angles formed by sighting a station on the opposite shore from each end of the 200-ft. line. Then they drew a similar triangle on paper, using 1 in. for each 200 ft. They found the altitude of the small triangle to be 22 in. What was the altitude (distance across the river) of the large triangle? (The altitudes of two similar triangles have the same ratio as any two corresponding sides.)

Finding a Distance across a River

4. To find the distance from *A* to *B* through the building shown in the picture at the top of page 250, drive a stake at *C*, where both *A* and *B* are visible. The point *C* is found to be 24 ft. from *A* and 15 ft. from *B*. Extend *BC* 5 ft. and *AC* 8 ft. beyond *C*, so that the line *EF* will be parallel to *AB*. When *EF* is measured, it is

found to be 10 ft. The triangles *ABC* and *CEF* are similar and have proportional sides.

Let x = the distance *AB*.

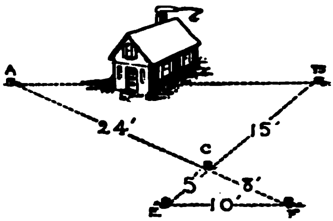
$5 : 15 = 10 : x.$

$x = ?$

or

$8 : 24 = 10 : x.$

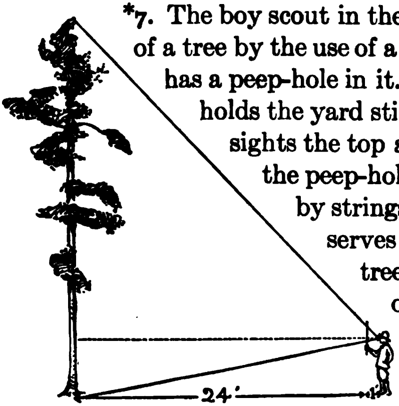
$x = ?$



Measuring the Distance through an Object

5. If $AC = 12$ ft., $CF = 3$ ft., $EC = 5$ ft., $BC = 20$ ft., $EF = 15$ ft., what does *AB* equal?

6. $AC = 15$ yd.; $CF = 3$ yd.; $EC = 5$ yd.; $CB = 25$ yd.; $EF = 5$ yd. What does *AB* equal?



Measuring the Height of a Tree

*7. The boy scout in the picture is measuring the height of a tree by the use of a yard stick and a cardboard that has a peep-hole in it. He stands 25 ft. from the tree, holds the yard stick exactly 1 ft. from his eye, and sights the top and the foot of the tree through the peep-hole in the cardboard, which is held by strings tied around his head. He observes that a line from the top of the tree passes through the 3-in. mark on the yard stick, and that a line from the foot of the tree passes through the 18-in. mark. Thus a triangle is formed whose altitude is 1 ft. and whose base is 15 in. (18 in. – 3 in.), or $1\frac{1}{4}$ ft. At the same time, a large triangle is formed whose altitude is 25 ft. and whose base is the height of the tree. These two triangles are similar because their corresponding angles are equal, and their corresponding sides proportional.

Let x = the height of the tree.

$x : \frac{5}{4} = 25 : 1$

$x = ?$

*8. If the lines of sight from the top and the foot of a tree pass through the 3-in. and the 18-in. mark, when a boy is standing 40 ft. from a tree with the yard stick 1 ft. in front of him, how high is the tree? (Make drawing.)

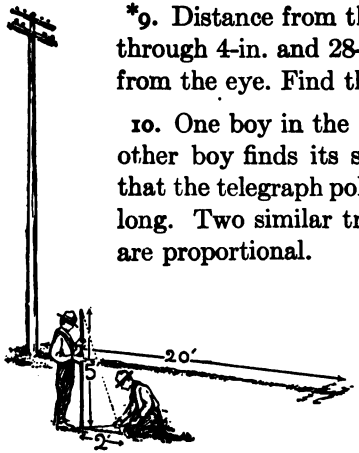
*9. Distance from the tree = 30 ft.; lines of sight pass through 4-in. and 28-in. marks on a yard stick held 1 ft. from the eye. Find the height of the tree.

10. One boy in the picture is holding a 5-ft. pole. The other boy finds its shadow to be 2 ft. long. They find that the telegraph pole beside them casts a shadow 20 ft. long. Two similar triangles are thus formed whose sides are proportional.

Let x = the height of the pole.

$$x : 5 = 20 : 2$$

$$x = ?$$



Measuring the Height of a Telegraph Pole by its Shadow

11. A telegraph pole casts a shadow 15 ft. long when a 5-ft. stick held in a similar position casts a shadow 2.5 ft. long. How high is the pole?

12. The length of the shadow of a tower is 100 ft. at the same time that a 6-ft. stick casts a 10-ft. shadow. What is the height of the tower?

*13. Bring to class a problem based upon your own measurements of shadows.

CHAPTER XI. REVIEW OF GRAMMAR SCHOOL ARITHMETIC

48. Computing with Integers, Fractions, and Decimals

I. Progress Score[1]

With the help of these tests measure your accuracy in computing with integers, fractions, and decimals. Try to make 100 points on each test, counting for each correct answer the score given below the letter of the problem. If you fail to get the correct answer to a problem, use for practice the exercise on pages 304–313 containing the same kind of problems.

Add: [Copy problems only when necessary.]

A. (5)

$$\begin{array}{r} 9\\ 6\\ 7\\ 5\\ 8\\ 4\\ 0\\ 8\\ 6\\ 2\\ 5\\ 5\\ \underline{7} \end{array}$$

B. (6)

$$\begin{array}{r} 647\\ 583\\ 654\\ 376\\ 594\\ 235\\ 453\\ 578\\ \underline{647} \end{array}$$

C. (7)

$$\begin{array}{r} 44287\\ 3965\\ 53437\\ 36572\\ 4325\\ 789\\ 4765\\ 3827\\ \underline{87654} \end{array}$$

D. (5)

$$\begin{array}{r} 27\frac{4}{9}\\ \underline{38\frac{2}{9}} \end{array}$$

E. (6)

$$\begin{array}{r} 44\frac{11}{16}\\ \underline{68\frac{5}{16}} \end{array}$$

F. (5)

$$\begin{array}{r} 65\,\frac{2}{3}\\ \underline{14\frac{2}{15}} \end{array}$$

G. (7)

$$\begin{array}{r} 72\,\frac{3}{4}\\ \underline{28\frac{11}{12}} \end{array}$$

H. (6)

$$\begin{array}{r} 24\frac{2}{3}\\ \underline{78\frac{1}{8}} \end{array}$$

I. (8)

$$\begin{array}{r} 39\,\frac{5}{9}\\ \underline{42\frac{11}{12}} \end{array}$$

[Write answer without copying problem.]

J. $19.78 + $7.45 + $16.29 = ?
(6)

K. $118\frac{2}{3} + 127\frac{8}{14} + 219\frac{1}{2} = ?$
(8)

L. $147.29 + $518.65 + $329.27 + $1293.87 + $639.45 = ?
(6)

---

[1] For measuring the progress of pupils, see footnote, page 37.

M. $\$1.05 + 15\frac{1}{2}¢ + 9\frac{1}{4}¢ + 7\frac{1}{2}$ mills $+ 8\frac{1}{2}$ mills $+ 1\frac{3}{4}¢ = ?$
(8)

N. $.372 + .364 + .072 + .42 + .743 + .893 + .09 = ?$
(6)

O. $19.32 + .07\frac{1}{4} + 4.1\frac{3}{8} + 8\frac{1}{2} + 6.07\frac{1}{2} = ?$
(11)

SUBTRACTION TEST

Subtract:

[Copy problems only when necessary.]

A. 846845
(5) $\underline{59687}$

B. 400700
(6) $\underline{123092}$

C. $34\frac{11}{12}$
(6) $\underline{28\frac{5}{12}}$

D. 64
(7) $\underline{18\frac{4}{9}}$

E. $40\frac{3}{8}$
(8) $\underline{21\frac{7}{8}}$

F. $78\frac{5}{12}$
(6) $\underline{29\frac{1}{4}}$

G. $52\frac{1}{8}$
(9) $\underline{38\frac{3}{4}}$

H. $36\frac{9}{10}$
(7) $\underline{18\frac{5}{6}}$

I. $82\frac{1}{5}$
(9) $\underline{48\frac{5}{6}}$

J. \$50.00
(5) $\underline{4.72}$

K. $\$21 - 43\frac{3}{8}¢ = ?$
(8)

L. $48.74 - 24.9 = ?$
(6)

M. $56.43 - 4.738 = ?$
(7)

N. $85\frac{1}{8} - 67.104 = ?$
(11)

MULTIPLICATION TEST

Multiply:

[Copy problems only when necessary.]

A. 7689
(5) $\underline{7}$

B. 6987
(6) $\underline{58}$

C. 4860
(6) $\underline{3060}$

D. $56 \times \frac{7}{8} = ?$
(3)

E. $\frac{5}{6} \times 250 = ?$
(7)

F. $24\frac{3}{4}$
(9) $\underline{5}$

G. 330
(11) $\underline{8\frac{2}{3}}$

H. 175
(12) $\underline{24\frac{3}{8}}$

I. $\frac{3}{8} \times \frac{4}{15} = ?$
(5)

J. $5\frac{1}{4} \times 4\frac{2}{3} = ?$
(8)

K. 7.25
(8) $\underline{4.8}$

L. .213
(8) $\underline{.025}$

M. $4.28 \times .3\frac{5}{8} = ?$
(12)

DIVISION TEST

[Copy problems only when necessary.]

A. $9\overline{)80169}$ (4)

B. $72\overline{)434880}$ (5)

C. $48\overline{)39992}$ (6)

D. $1690\overline{)13452400}$ (9)

E. $15 \div \frac{3}{4} = ?$ (5)

F. $\frac{2}{3} \div \frac{5}{8} = ?$ (5)

G. $\frac{11}{16} \div 3 = ?$ (5)

H. $5\frac{3}{4} \div 3 = ?$ (6)

I. $3\frac{3}{8} \div 1\frac{4}{5} = ?$ (7)

J. $61\overline{)257.03}$ (8)

K. $12.5\overline{).1375}$ (7)

L. $.014\overline{).924}$ (6)

M. $.75\overline{)3150}$ (8)

N. $3000\overline{)\$860}$ (8)

O. $\dfrac{2 \times (72.4 - 8.27)}{12\frac{1}{2}} = ?$ (11)

II. PROBLEMS

[With pencil.]

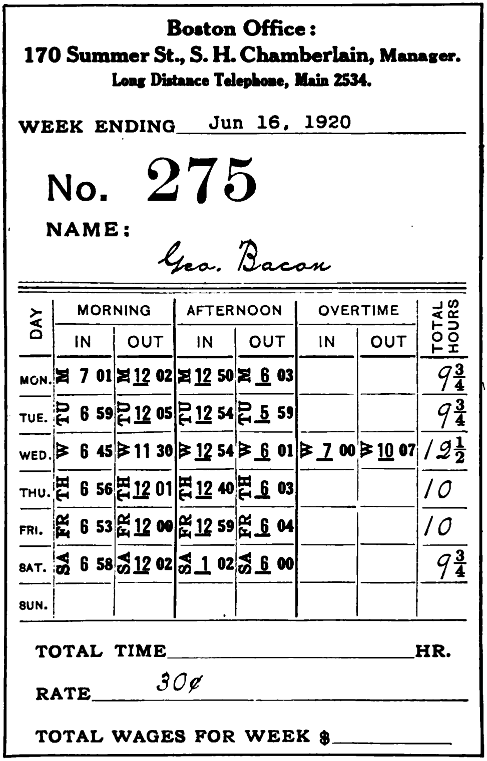
1. Balance the following expense account: Received from the sale of cattle, $950.00; from wheat, $848.60; from corn, $725.40; from hay, $240.90; from fruit, $640.95; from other farm produce, $898.40. Paid for seed, $350.75; for cattle, $450; for fertilizer, $215.50; for labor, $1200; for machinery and repairs, $225; for incidentals, $49.65.

2. The purchases charged on a monthly statement are: $12\frac{3}{4}$ yd. silk at $1.25; $6\frac{1}{2}$ yd. lining at 25¢; $\frac{1}{2}$ doz. spools of thread at 96¢ a dozen; 1 bolt of taffeta ribbon at $3.50; $9\frac{7}{8}$ yd. velvet ribbon at 33¢; $1\frac{1}{2}$ doz. buttons at 25¢ a dozen. Credit is given for 5 yd. ribbon at 35¢ a yard. Find the balance due.

3. The fuel bill for a family for one month was: $1\frac{1}{2}$ tons of coal at $11.75; 3500 feet of gas at 90¢ per thousand feet. The father's salary was $150 a month. The fuel bill was what part of this salary?

4. The bills for meats and groceries in this same family (problem 3) amounted to $30 a month. This was what part of the father's salary?

5. From this time card of a factory employee, find the total number of hours of work, and the total wages for the week. (Note that when an employee is late, a quarter of an hour is deducted from the day's time, even should he be but one minute late. No extra time is allowed for being a few minutes early, or for staying a few minutes past the time.)



Boston Office:
170 Summer St., S. H. Chamberlain, Manager.
Long Distance Telephone, Main 2534.

WEEK ENDING Jun 16, 1920

No. 275

NAME:
Geo. Bacon

DAY	MORNING		AFTERNOON		OVERTIME		TOTAL HOURS
	IN	OUT	IN	OUT	IN	OUT	
MON.	M 7 01	M 12 02	M 12 50	M 6 03			$9\frac{3}{4}$
TUE.	TU 6 59	TU 12 05	TU 12 54	TU 5 59			$9\frac{3}{4}$
WED.	W 6 45	W 11 30	W 12 54	W 6 01	W 7 00	W 10 07	$12\frac{1}{2}$
THU.	TH 6 56	TH 12 01	TH 12 40	TH 6 03			10
FRI.	FR 6 53	FR 12 00	FR 12 59	FR 6 04			10
SAT.	SA 6 58	SA 12 02	SA 1 02	SA 6 00			$9\frac{3}{4}$
SUN.							

TOTAL TIME ______________ HR.

RATE 30¢

TOTAL WAGES FOR WEEK $ __________

6. In a hat factory, one girl prepared $3\frac{1}{2}$ doz. hats during one week, receiving 54¢ per hat. Another girl trimmed twice as many hats, at 30¢ each. A third girl designed three hats and received $10 for each hat. What was the pay of each girl for the week?

7. Find the total amount of the following bill of goods:[1]

1 piece Dress Goods, 55¾ yd. @	75¢		
3 pc. Sheeting, 42¼, 41½, 43¾ yd. @......	26¢		
2 pc. Veiling, 23½, 22¾ yd. @............	75¢		
1 pc. Jeans, 46 yd. @..................	37½¢		

8. The number of cubic feet registered on a gas meter, May 26, was 28,800. June 26, the meter read 36,200 cu. ft. What was the amount of the gas bill for that month at 90¢ a thousand cubic feet?

9. The materials required in making a school dress, which can be bought ready made for $29.50, are as follows: 4½ yd. double width cheviot at $2.50; 8 yd. of braid for trimming at $.50; linings, $2.50; findings, $1.50. Allowing $8 for the making, find the difference in cost between buying the materials and having the dress made, and buying it ready made.

10. In purchasing dress goods, it is usually most economical to buy a quality that sells for a medium price. It seldom pays, for example, to buy serge for less than $2.50 a yard. A dress requiring 6¾ yd., when made of $1.00 serge, lasts 4 months; when made of $2.50 serge, 10 months. After allowing for each dress a total of $15 for the trimming, lining, and making, find the difference in the cost per month.

11. The English language is spoken by about 160,000,000 persons; German, by 130,000,000 persons; Russian, by 100,000,000 persons; French, by 70,000,000 persons; Italian and Spanish, each by 50,000,000 persons; and Portuguese, by 25,000,000 persons. What part of all these persons using the European languages speak the English language? The French language?

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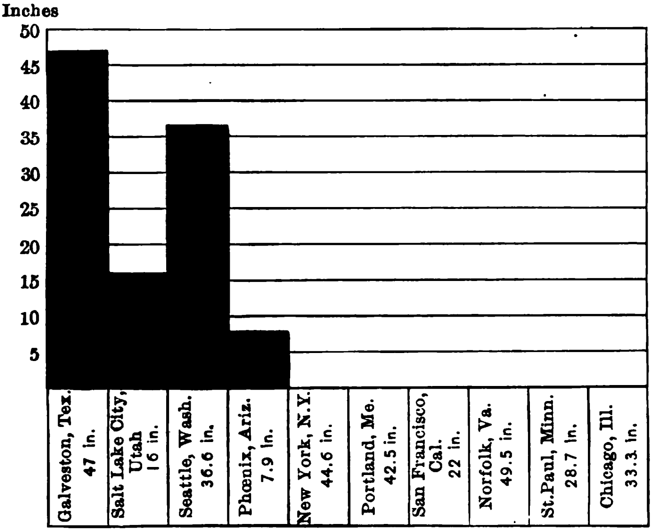
[1] In solving this problem, the pupil should remember to use the rule for approximating answers. Compute the amount for each item to the nearest cent and discard the mills. For example, $27.03875 should be written $27.04.



Annual Rainfall

12. Copy and complete this graph, showing the average rainfall (including melted snow) for ten cities.

13. FOURTH OF JULY ACCIDENTS

Year	Killed	Injured	Total	Year	Killed	Injured	Total
1904..........	183	3,986	4,169	1910............	131	2,792	2,923
1905..........	182	4,994	5,176	1911............	57	1,546	1,603
1906..........	158	5,308	5,466	1912............	41	947	988
1907..........	164	4,249	4,413	1913............	32	1,131	1,163
1908..........	163	5,460	5,623				
1909..........	215	5,092	5,307	Total, 10 years			

From the table above, showing Fourth of July accidents, find (1) the total number of those killed, (2) the total number injured, and (3) the total number of accidents in the 10 years.

14. Find the average number killed and the average number injured for the ten years. How much less than these averages are the corresponding figures for 1913?

*15. Make a graph showing the number killed for each of the ten years. Let $\frac{1}{8}$ of an inch equal 10 killed.

49. The Algebraic Equation as a Tool in Solving Problems

I

[Without pencil.]

1. Name the operation indicated in each of the following:

$$3 + 4;\ \ 18 - 7;\ \ \tfrac{8}{4};\ \ 5 \times 8;\ \ a + b;\ \ 19 - x;\ \ \tfrac{c}{4};\ \ 5a.$$

2. Make an original problem for each operation indicated above.

Indicate the operation to be performed in answering each of the following questions:

3. John is a years old now. How old will he be in 3 years?

Ans. $a + 3$ years.

4. A man is now 50 years old. How old will he be in x years?

5. There are, on an average, 25 books on each shelf in the library. If there are b shelves, how many books are there in the library?

6. There are 48 desks in c equal rows. How many desks are there in each row?

7. A room has x girls and y boys. How many children in the room?

8. Caroline is x years old. How old was she 5 years ago?

9. Harry earned x cents on Monday, and 25¢ more on Tuesday. How much did he earn in the two days?

10. The length of a room is x feet; the width, y feet. What is the floor space?

11. What length of picture molding would the room in problem 10 require?

12. How many feet wide is a lot which contains a square yards and is b feet deep?

13. How many acres in a lot whose dimensions are x rods by z rods?

14. One side of a triangle is x inches long, a second side is y inches, and the third side is z inches. What is the perimeter of the triangle?

15. One side of a square field is z feet. How much fencing will the field require?

16. A piece of property that cost b dollars was sold at an increase of $16\frac{2}{3}\%$. What was the selling price?

17. An agent collected c dollars, on which he received 2%. How much did he return to his employer?

18. Find the cost of a lot a ft. wide and b ft. deep at \$5 per sq. ft. At c dollars per front foot?

19. A discount of 10% was allowed on a bill of c dollars. What was the net price?

20. An auto travels m miles per hour. How far will it travel in d days of r hours each?

21. A teacher cut d yd. of ribbon into lengths of b in. each, for badges. How many children did she supply?

22. Mr. Boyd sold z bu. of cherries at x cents a qt. How much did they bring?

23. If you cover d feet in one step, how many steps do you take in walking a mile?

24. If you loan x dollars at 4% for t years, how much would you receive at the end of that time?

25. A merchant spent x dollars for tablets at b cents each. How many did he buy?

26. A square field is x rd. wide. How many rd. of fence will enclose it?

27. A cow yields y gal. of milk per day. How many quarts is that per week?

II

The statement of an equality is called an **equation.**

1. Tell which of the following expressions are equations:

$$5 \times 9;\ 9 + 8 = 17;\ \tfrac{45}{9} = 5;\ 6 \times 8 = 48;\ 175 \text{ bu.}$$

$$32 \text{ qt.} = 1 \text{ bu.};\ \frac{1 \text{ acre}}{1 \text{ sq. rd.}} = 160;\ 3 \text{ ft.} + 4 \text{ yd.} = 15 \text{ ft.}$$

$$x + y = z.$$

The use of letters to represent numbers in equations is of great advantage in solving many problems. When you use the equation, you are merely using a new method of solving problems that heretofore you may have solved in some other way.

[With pencil.]

2. If meat costs 3 times as much as fish, and I spend $1.50 in buying 2 lb. of meat and 4 lb. of fish, what is the cost of each per pound?

Let x = cost of 1 lb. of fish.
Then $3x$ = cost of 1 lb. of meat.
$4x$ = cost of 4 lb. of fish.
$6x$ = cost of 2 lb. of meat.
$4x + 6x = \$1.50.$
$10x = \$1.50.$
x = —, cost of 1 lb. of fish
$3x$ = —, cost of 1 lb. of meat.

3. If silk cost twice as much as linen, and I spend $22.40 in buying 10 yd. of silk and 8 yd. of linen, what is the cost of each per yard?

4. A rectangular field is twice as long as it is wide, and the distance around it is 216 rd. Find its dimensions.

5. Tom, Will, and Frank caught 48 trout. Tom caught twice as many as Will, and Frank caught as many as both Tom and Will. How many did each boy catch?

6. John paid \$2.10 for a geography and a reader. The geography cost twice as much as the reader. Find the cost of each.

7. There were 96 persons employed in a store. The number of women was three times the number of men. How many men and how many women were employed?

8. One number is 4 times another, and their difference is 24. Find the numbers.

III

Balances

An equation is like a pair of balances. When does the scale beam balance?

If you put an 8-oz. weight and a 4-oz. weight into one scale pan and 12 oz. of sugar into the other scale pan, will the beam balance?

The scales will read 8 oz. + 4 oz. = 12 oz.

If you add a 4-oz. weight to the weight pan, what will happen? Will there be a balance then? What can you do to the sugar pan to restore a balance?

8 oz. + 4 oz. + 4 oz. = 12 oz. + 4 oz.

If you take off a 4-oz. weight from the weight pan, what must you do to the other side to keep the balance?

8 oz. + 4 oz. − 4 oz. = 12 oz. − 4 oz.

If you put two times as much sugar into the sugar pan, what must you do to the weight pan to keep a balance?

2 (8 oz. + 4 oz.) = 2 × 12 oz.

If you divide the sugar into two equal parts and take one part off the scale pan, what must you do to the weight pan?

$$\frac{8\text{ oz.} + 4\text{ oz.}}{2} = \frac{12\text{ oz.}}{2}$$

The following operations may be performed on the equation without destroying the equality of its two members:

The same number may be added to both sides.
The same number may be subtracted from both sides.
Both sides may be multiplied by the same number.
Both sides may be divided by the same number.

(1) If, from twice a certain number, we subtract 7, the result is 15. Find the number.

Let x = the number.
Then $2x - 7 = 15.$
(Adding 7 to each side) $2x - 7 + 7 = 15 + 7.$
$2x = 22.$
$x = 11$, the number.

(2) Cut a stick 50 in. long into two parts whose difference in length is 26 in.

Let x in. = length of the shorter part.
Then x in. + 26 in. = length of the longer part.
$x + x + 26 = 50.$
(Subtracting 26 from both sides)
$x + x + 26 - 26 = 50 - 26.$
$2x = 24.$
$x = 12$ in., length of the shorter part.
$x + 26 = 38$ in., length of the longer part.

(3) If an automobile goes 70 miles in 6 hours, at the same rate how far would it travel in 15 hr.?

Let x = mi. it goes in 15 hr.
Then $\frac{x}{15}$ = mi. it goes in 1 hr.
$\frac{70}{6}$ = mi. it goes in 1 hr.
$\frac{x}{15} = \frac{70}{6}.$

(Multiplying both sides by 30)

$$2x = 350.$$

$$x = 175 \text{ mi. traveled in 15 hr.}$$

(4) A man lost 20% of his capital and had \$16,000 left. How much had he at first?

Let x = the amount he had at first.

Then $x - \frac{1}{5}x = 16000.$

$$\tfrac{4}{5}x = 16000.$$

(Dividing both sides by $\frac{4}{5}$) $x = \$20{,}000$, amount he had at first.

Find the value of x: [Without pencil.]

1. $x - 14 = 35.$
2. $x + 2 = 16.$
3. $x + 8 = 20.$
4. $x + 3 = 9.$
5. $\frac{2}{3} = \frac{x}{18}.$
6. $\frac{x}{32} = \frac{3}{4}.$
7. $\frac{4}{5x} = 32.$
8. $x - 6 = 42 - x.$
9. $x + 9 - 4 = 7 - x.$
10. $2x - 3 = 2 + x.$

[With pencil.]

11. If 4 men can complete an excavation in $7\frac{1}{2}$ days, in how many days could 15 men complete it, working at the same rate?

12. $312\frac{1}{2}$ is $62\frac{1}{2}$% of a certain number. What is $87\frac{1}{2}$% of the same number?

13. What sum of money must be invested at 5% to amount to \$5000 in 5 yr.?

14. When 60 bu. of oats cost \$54, what will 25 bu. cost?

15. In a family where there are three children, each child is 3 years older than the next younger. The sum of their ages is 36 years. Find the age of each.

16. The capacity of a shoe factory is 2580 pairs of shoes per week. How long will it take to fill an order for 35,260 pairs?

17. I paid \$350 for a piano at 30% discount. What was the original price of the piano?

18. I bought some five-cent stamps and twice as many two-cent stamps, paying for the whole number 81 cents. How many of each kind did I buy?

19. A grocer sold 27 lb. of sugar, tea, and meal. He sold 3 lb. more meal than tea, and 6 lb. more sugar than meal. How many pounds of each did he sell?

20. A lot was sold for $840 at a loss of 12½% of the cost. What was the loss?

21. Thirty yards of cloth and twenty yards of silk together cost $70; the silk cost twice as much per yard as the cloth. How much does each cost per yard?

22. A man makes a journey of 224 miles. He motors 5 times as many miles as he walks and rides on the train 15 miles more than he motors. How far does he ride on the train?

23. I bought a number of books one day, 4 times as many the next day, and 8 books the third day. In all, I bought 38 books. How many did I buy the second day?

24. Ten pounds of potatoes contain 7.83 pounds of water. How much water does a bushel (60 lb.) contain?

25. John, Frank, and Harry caught 128 fish. Frank caught 10 more than John. Harry caught 3 times as many as John and Frank together. How many did each catch?

26. A $6400 estate is divided among two sons and two daughters. The daughters receive equal parts. Each son lacks $400 of receiving 3 times as much as each daughter. How much does each son and each daughter receive?

27. If 17 acres yield 357 bushels of grain, how much will 24 acres yield at the same rate?

28. If it requires 200 lb. of coal to run a locomotive 6 hours, how many tons will be consumed in making 15 trips of 8 hours each?

29. If 80 tons of coal cost $340, how much will 124 tons cost?

30. A second reader cost 10¢ more than a first, and a third reader 10¢ more than a second. If the three books cost $1.50, what was the cost of each book?

31. If 154 bu. of wheat are required to make 44 bbl. of flour, how many bushels will be required to make 26 bbl.?

32. $840 yields a profit of $42 in one year. At the same rate, how much profit will $945 yield in the same time?

33. A piece of property sold for $4900 at an advance of 16$\frac{2}{3}$%. What was the gain?

34. At a discount sale of 25%, a hat sold for $15. What was its original price?

35. At the last census, a town had a population of 60,000. This was a 11$\frac{1}{9}$% increase over the population at the preceding census. What was the increase in population?

Note to Pupil: In the future, in solving problems, use the algebraic equation whenever it will shorten the work.

50. Percentage

[With pencil.]

1. A boy worked for a year at 90¢ per day. The second year his wages were increased 20%; the third year his wages were increased 42¢ a day more than the second year. Allowing 300 working days to the year, what was his income the third year?

2. A certain grade of paper cost $36 per ream of 480 sheets. When bought in quantities of less than a ream, 10% is added. Find the cost of 100 sheets.

3. The fuel bill for a family for one month was: coal, 2 tons at $12; gas, 3500 feet at 80¢ per thousand. If the father receives a salary of $200 per month, the fuel bill is what per cent of his salary?

4. Seventy-five pounds of bronze is to contain 45% zinc, 9 pounds tin, and the remainder copper. What per cent of the bronze is copper?

5. A pupil who attended school 85½ days during a term was graded 95% in attendance. How many days was he absent?

6. In one year the United States sold $37,800,000 worth of bread stuffs to Great Britain; 25% as much to Holland and Belgium; 20% as much to Germany; and 10% as much to France as to Germany. What was the total value of the bread stuffs to these countries?

7. A certain high school has 368 pupils. This is an increase of 15% over last year. How many pupils attended the school last year?

8. By the use of fertilizer, a farmer increased the yield of a 10-acre corn field 40%. If the yield the preceding year was 320 bushels, how much was the yield per acre after fertilizing?

9. In 12 oz. of wheat flour there are 1.37 oz. of water, 1.66 oz. of proteid, 8.65 oz. of carbohydrate, and .23 oz. of fat. The rest is waste. What per cent is waste?

10. If .375 of a boy's time is spent in sleep, .25 in play, .2 in helping in the work at home, and the remainder in school, what per cent of his time is spent in school?

11. A, B, and C engaged in business. A furnished ⅓ of the capital; B, ⅔ of the capital. C conducted the business for 50% of the net earnings. The receipts for one year were $19,200. The total expenses were 75% of the receipts. What was A's share of the profits?

12. A railway train, running at an average rate of 35 mi. an hour for 2 hr. 48 min., passes over 35% of a conductor's run. What is the length of his run?

13. A farmer raised this year 7421.1 bu. of grain. This is an increase of 8.75% over last year's crop, due to fertilizing. What was last year's crop?

14. If I mix 18 gal. of water with 22 gal. of grape juice, what per cent of the mixture is water?

15. In a mill, 2800 operatives earn on an average $3.18 per day. If their wages are increased 10%, what will be the increase in the weekly pay roll, allowing 6 days to the week?

16. How many cubic feet of oxygen are there in a room 32 ft. long, 28 ft. wide, 11 ft. high, when oxygen makes up 20% of the air?

17. A man bought a tract of forest land containing 248 acres. The first year he cleared 12½% of it. 16⅔% of this clearing was set in peach trees. How many acres were there in the peach orchard?

18. Five years ago a city had a population of 22,850. Since then the population has increased 38%. What is its population now?

19. My gas bill last month was $4.50. This month it is $5.20. What is the per cent of increase?

20. After drawing 736 gallons of water from a full cistern, there remained 8% of the water originally in it. What is the capacity of the cistern?

21. A young man who is working his way through college gets $3 every Saturday for clerking. For collecting and delivering laundry he earns $2.25 additional each week. His regular expenses are $6 a week for board and $2.50 for room rent. Other expenses for the 36 weeks of the college year are $167.50. What per cent of his expenses is he enabled to pay from his earnings during the school year?

22. Mr. Jacobs sold 30% of his farm at one time, 60% at another, and 4% at another, and then had 63 acres left. How much land has he at first?

23. The exports of the United States during a recent year amounted to $5,900,000,000. During the same year, the imports amounted to $3,000,000,000. Our exports were what per cent of our imports? Our imports were what per cent of our exports?

*24. The salt water drawn from the bottom of a mine of rock salt contained 8% of its weight of pure salt. What weight of salt water was it necessary to evaporate in order to obtain 3896 lb. of salt?

51. Applications of Percentage

I. TRADE OR COMMERCIAL DISCOUNT

[With pencil.]

1. At a "closing out" sale, I purchased, at a discount of 25%, a suit marked $45, a coat marked $28.50, a hat marked $3.25, and a pair of gloves marked $1.50. Find the total amount of my bill.

2. A cloak marked $45 is put upon a bargain counter, its price to be reduced 10% daily until the cloak is sold. It is purchased on the third day. What is the price paid for it?

3. A music teacher purchased for a school six hundred 15-cent song pamphlets. She received a bill from the music house for $57.60. What was the per cent of discount allowed?

4. A piano is bought for $250 at a discount of 33⅓%. What is the catalogue or list price of the piano?

5. An invoice of goods shipped to a hardware dealer contains the following items: 24 bales of barbed wire @ $4.30; 12 kegs of nails @ $4.50; 150 lb. of screws @ $6.75 per hundredweight. The terms of sale are 60 days net; or, if the bill is paid within 10 days, a discount of 2%. Find the amount due if the bill is paid immediately.

6. Find the amount due on a bill for $1750 with 10% and 5% off.

7. A grocer buys 30 sacks of flour @ $1.72; 120 lb. of coffee @ $.48; 60 lb. of butter @ $.55; 50 lb. of lard @ $.26; 300 lb. of sugar @ $.11. Discounts 20 and 3%. Find the amount due on the discounted bill.

8. A supply agent for the schools in a city bought 500 readers listed at $.45; 600 listed at $.60; 450 listed at $.75. He received a discount of 20%. How much did the books cost the school board?

9. What single discount do 20% and 10% off equal?

10. A dealer buys 40 doz. pocket knives at $16.80 per dozen, with discounts of 25, 10, and 2%. He sells the knives at $1.50 apiece. How much does he gain on each dozen?

11. Find the net price of 2 tons of fence wire listed at 6¢ per pound and sold at 25 and 20% off.

12. The catalogue price of a rug is $120. The discounts allowed are $16\frac{2}{3}$ and $12\frac{1}{2}\%$, with 5% off for cash. What is the cash price?

13. Two wholesale hatters, A and B, make the same quality of hats. A's list price is $25 per dozen, 20 and 5% off. B's list price is $27 per dozen, 25 and 10% off. How much can be saved by ordering one dozen hats from B?

14. I paid $31.50 for a suit at a "closing out" sale, at which 10% discount was allowed on all goods. How much did I save by purchasing at the sale?

15. A $75 couch that had been damaged by smoke was sold for $60. What was the per cent of discount?

16. Find the cost, to the buyer for a department store, of 817 misses' suits at $16, with discounts of 20 and 2%.

17. Find the amount required to settle for the following invoice of house furnishings, discounts of 25 and 10% being allowed:

8 dining chairs	@ $10.00
12 sets of dining chairs	@ 38.50
10 bookcases	@ 17.50
8 rocking chairs	@ 22.75
15 center tables	@ 25.00

18. A sales clerk receives a discount of 10% upon all goods that she buys in the store where she is employed. How much does she save in all on the following purchases: A yard of all-over embroidery listed at $2.75; a waist listed at $4.50; 7 yd. of muslin listed at 20¢ a yard?

*19. A dealer buys 25 doz. pocket knives at $7.20 per dozen, with discounts of 25, 10, and 2%. He sells them at 75¢ each. How much is his gross profit on each knife? On the entire purchase?

***20.** A wholesale grocer bought sugar to the amount of $725 on 90 days' time. Being offered 5% off for cash, he borrowed the money for 90 days at 6% and paid the bill at once. How much did he save by the transaction?

***21.** A woman purchased a piano, the price of which was $575. She was offered the choice of a discount of 10% for cash, or payment by installment, $25 down, and $25 a month until paid. Not counting interest, how much more did the piano cost her if she accepted the installment plan?

II. COMMISSION

[With pencil.]

1. An auctioneer sells at auction 2 wagons, one for $28.75, the other for $61.60; 1 wheelbarrow for $4.90; 20 tons of hay at $19.75; 8 cows at an average price of $70 apiece; and 26 hogs at $15.30. What is his commission at 2%?

2. A salesman receives a monthly salary of $60 and, in addition, a commission of 5% on his sales. His sales must amount to what sum annually to give him an income of $1800?

3. A real estate agent charges 5% of the value of real estate for selling it and 2% of all rent collected. Find how much he should receive for selling a house valued at $4500 and for collecting rents for the following amounts: $22.50, $27.50, $40.00, $18.50, and $45.00.

4. A lawyer collected 90% of a debt amounting to $4680, charging his client 5% of the amount collected. How much did the client receive?

5. A manufacturer sells through an agent 7300 yards of carpeting at $2.50 a yard, paying him $\frac{3}{4}$% commission. The freight amounts to $7.37. How much per yard does the manufacturer realize?

6. A real estate agent charged for selling a $10,000 estate and collecting, 2% on the first $2000, 3% on the next $3000, and 4% on the remainder. What was the amount of his commission?

7. A commission merchant charged \$234 for buying 300 bbl. of flour at \$12.50. What was his rate of commission?

8. A dealer buys 1000 dozen eggs at 53 cents, and sells them through a commission merchant at 59 cents. What is his profit, if the rate of commission is 2%?

9. I employed a lawyer to collect a debt of \$3600. He succeeded in getting 80% of it, on which he charged a commission of 5%. How much did I receive?

10. An agent sold a farm of 150 acres at \$95 an acre, on a commission of 2½%. How much did the man for whom the land was sold gain, if he bought the land at \$87.50 an acre?

11. My agent sold 500 bbl. of flour at \$13 a barrel and sent me a check for \$4750. What rate of commission did he charge?

12. An auctioneer's commissions at 2½% amounted to \$3124.80 in a year. He held auctions on 265 days. What was the average amount of each day's sales?

13. The managers of a department store, whose sales in a recent year amounted to \$2,780,000, collected 98% of this amount through their usual channels. The uncollected bills were turned over to a collecting agency, which collected one half of the balance due, charging the store a commission of 5% on the amount collected. How much commission did the collecting agency receive? How much money did the store fail to collect?

14. A commission agent sells for a fruit grower 150 boxes of oranges at \$4.50 and 300 boxes of grapefruit at \$6.00, charging as his commission, 5%. What were the net proceeds received by the fruit grower?

15. What are the net proceeds on a sale of 576 bbl. of flour at \$12.50, if the commission paid is 3½%, and the freight and storage charges together amount to 66¢ a barrel?

*16. An agent's commission for selling 360 yd. of cloth at \$3.25 a yard was \$46.80. What was his rate of commission?

*17. A book agent sold 84 books at $1.75 apiece and, after deducting his commission, remitted $88.20 to the publisher. What was the rate of his commission?

*18. A grain dealer paid his agent $71.28 commission for buying corn. The rate of commission was 1½%, and the price paid was $1.60 per bushel. How many bushels did he buy?

III. GROSS AND NET PROFIT

[With pencil.]

1. A hardware dealer sells a kitchen range for $90. Of the amount received, 22% is the cost of selling the range; and 65%, the price paid for the range at wholesale. The remainder is net profit. Find the amount of each item.

2. A lawn mower is bought for $6.75 and sold for $10.50. The gross profit is what per cent of the selling price? Of the cost?

3. The cost of selling the lawn mower (problem 2) was 20% of the amount received for it. What per cent of the selling price was net profit?

4. The gross profit is what per cent of the selling price when goods are bought at wholesale for $3,275 and sold at retail for $4,524.72?

5. A lumber dealer purchased a carload of shingles (200,000) in Oregon at $3.50 per thousand. He paid $300 freight, and then sold them for $7.20 per thousand. Allowing 10% of the receipts for the expense of handling, what per cent of the receipts was net profit?

6. It costs a grocer 20% of his receipts to pay the running expenses of his business. At that rate, how much must he charge for a barrel of flour bought at wholesale for $10.50, in order to clear the expense of handling the flour and make a net profit equal to 10% of the selling price?

Let x (or 100%) = selling price of barrel of flour.

7. The grocer bought a box containing 150 oranges for $4.50 and sold them for 60¢ a dozen. The gross profit was what per cent of the cost of the oranges? What per cent of the selling price?

8. Including 25% of selling price for expenses, what per cent of the selling price was net gain? (See problem 7.)

9. For his Thanksgiving trade, a wholesale grocer bought, at $8.50 a barrel, a carload of cranberries containing 150 barrels. The freight charges were 50¢ a barrel. At what price per barrel was it necessary to sell the cranberries to make a gross profit equal to 20% of the selling price?

10. A farmer bought 24 head of cattle at $80 a head. After losing two of them, he sold the remainder at $105 per head. What per cent of the cost was his gross profit?

11. A wholesale house bought coffee at $500 a ton (2000 lb.). At what price per pound should it be sold to make a gross profit of 50% on the cost?

12. Mr. Jameson sold a piece of land for $3280 and lost thereby 18% of the price he paid for it. How much did he pay for it?

13. A dealer bought 100 bu. of potatoes at $1.60 a bushel. He lost 10% of them by freezing and decay. At what price per bushel must he sell the remainder to gain 20% on the investment?

*14. A grocer bought 6 bags of Rio coffee, 125 lb. to a bag, at 30¢ a pound, and 9 bags of Java coffee, 75 lb. to a bag, at 40¢ a pound. He mixed the two and sold the mixture at 56¢ a pound. His gross profit was what per cent of the cost?

IV. LOANING MONEY AT INTEREST

[With pencil.]

1. A man deposited $4500 in a bank that pays him 3½% yearly interest. He withdraws his interest semi-annually. How much does he withdraw at each interest-paying time?

2. S. H. Peterson has in his possession three notes as follows: \$250 at 6%; \$1400 at 5%; \$75 at 8%. How much more is his income for one year from these notes than it would be from the same amount of money in a savings bank paying 4% interest, compounded semi-annually?

3. A man loaned \$950, Nov. 21, 1919, at 7%. What amount was due him June 3, 1920?

4. A woman opened an account with a savings bank that pays 2% interest semi-annually. How much may she withdraw if she deposited \$225, and allowed it to remain through three interest-paying periods without drawing the interest?

5. Mr. Stone borrowed \$2440 of Mr. Long at 6%. He kept it 3 years, 8 months, 15 days without paying interest. What was his total indebtedness at the end of the period?

6. Find the interest on \$238 for 1 year, 5 months, 12 days, at 5%.

7. Mr. Ames holds a note of \$500 against me. It has been running 6 months and 15 days at 5%, during which time I have paid no interest. How much do I owe him?

8. I bought 30 shares of Building and Loan stock upon which I pay 50 cents a month per share. After paying for four years I draw out my money and receive \$756. How much interest do I receive?

9. A man deposits \$450 in a savings bank paying 4½% compound interest, and leaves it through two interest terms of 6 months each. He then draws out the deposit and the accrued interest. How much does he draw out?

10. Find the interest on \$750.75 at 5% for 3 years, 5 months, 10 days.

11. Find the amount of \$2350 for 2 years, 3 months, 16 days, at 6%.

12. A man borrowed $2700 Nov. 11, 1919, with interest at 5%. Find the amount of his debt August 5, 1920.

13. I promised to pay on demand a note for $425 with interest at 5%. At the expiration of 4 months, 20 days, the interest and the principal were paid. How much was paid?

14. A woman having $200 surplus money can lend it on a personal note at 5% interest, or place it in a savings bank at 4% interest compounded semi-annually. Which will bring the greater return the first year? How much greater?

15. Find the interest on $469.12 at 6% from June 8, 1920, to August 15, 1921.

16. I deposit $380 with a trust company that pays 2% interest semi-annually. If I leave my money through 4 interest-paying periods, how much may I withdraw?

17. A note for $380 is dated April 14, 1920. Find the interest at 6% due Sept. 2, 1920.

18. What is the compound interest on $500 for $1\frac{1}{2}$ years at 4%, compounded semi-annually?

19. What amount will be needed to pay a note for $275 for 60 days at 7%?

20. I have a $100 Liberty bond bearing interest at $4\frac{1}{4}$ %. How much shall I receive in interest payments on the bond in 25 years?

21. How much more interest would I receive in a year from $1000 deposited in a Savings Bank that pays 4% interest compounded quarterly than from a bank that pays the same rate of interest but adds interest only at the end of the year?

***22.** What is the compound interest on $500 deposited with a trust company for three years at $4\frac{1}{2}$%, if the interest is compounded annually?

V. THE RETURN ON AN INVESTMENT

[With pencil.]

1. The capital required to run a small grocery is $8000; the net profit is $3500. Find the return on the investment.

2. Find the return on an investment when a house is bought for $4500 and rented for $45 a month. The yearly expenses are: taxes, $83.25; insurance, $9.00; repairs, $92.50.

3. A fruit peddler buys each day a cartload of bananas for $9.00, which he sells before night for $12.50. Allowing $3.00 a day for the value of the peddler's time and 200 days as the number of days in the year in which he can do business, find what sum invested in a business paying yearly dividends of 10% would be required to yield as large an annual income as the peddler's original capital of $9.00.

4. A merchant owns $\frac{5}{8}$ of the capital of $10,000 invested in a dry-goods store. The total annual receipts amount to $45,750; the expenses of running the store, to $11,540; the cost of the goods sold amounts to $28,450. The merchant receives a salary of $2000 from the store. Find his total income.

5. What is the return on investment in a business when the receipts are $50,000, and the total expense is $41,000, if the capital invested is $24,000?

6. A man buys 50 shares of stock in a mine at 150$\frac{1}{4}$, brokerage $\frac{1}{8}$%. What is his bill?

7. During the following year the mine pays dividends of 15%. The investment yielded what per cent? (See problem 6.)

8. At the end of the year the mining stock was sold at 140$\frac{1}{4}$. The loss, including brokerage, was what per cent of the amount paid for the stock? (See problems 6 and 7.)

9. Find the return on 10 shares of railway stock, bought for 122$\frac{7}{8}$ (brokerage $\frac{1}{8}$%) and paying an annual dividend of 6%.

10. I bought five $1000 Panama 3's at 102, on which there was no brokerage. Find the cost.

11. I received one year's interest on the bonds (problem 10). The income was what per cent of the investment?

12. I then sold the bonds at 105, paying the usual brokerage. The gain, including interest, was what per cent of the amount invested?

13. A man receives $900 annually from telephone bonds paying 4 per cent. What is their face value?

*14. Fred bought a $100 3½% Liberty bond on the date that it was issued, June 15, 1917. If he keeps it until it matures, June 15, 1947, cashing the interest coupons as they come due, what will be the total amount he will receive for the coupons?

52. Measurements

[With pencil.]

1. A man had 3 tracts of land, each containing 6¼ acres. He divided them into building lots 82.5 ft. wide and 330 ft. deep, and sold them at an average of $250 per lot. How much did he get for the land?

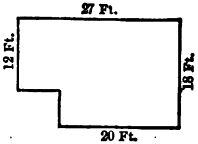
2. A schoolroom is 32 ft. long, 28.5 ft. wide, and 16 ft. high. How many cubic feet of air space are there per person when 34 pupils are seated with the teacher in this room?

3. A class of girls made 5 bags, 8 calendars, and 7 letter cases. Each bag required 18 in. of ribbon; each calendar, 9 in.; each case, ⅝ of a yard. How much did the ribbon cost at 4.5 cents per yard?

4. A walk along the side of a park is made of boards 2 inches thick. How many board feet are required if the walk is 200 ft. long and 4 ft. 6 in. wide?

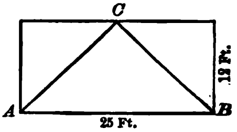
5. What will be the cost of joists (problem 4) 15 ft. long, 12 in. wide, and 3 in. thick, at $34.50 per M?

6. I sold 80 sq. rd. of land from a field 80 rd. square. What is the remainder worth at $75 an acre?



7. This drawing represents the floor plan of the cellar of a house. How much will it cost to cement the floor at $2.50 per square yard?

8. How many cubic feet of earth will be removed in digging a cellar 20 ft. long, 16 ft. wide, and 8 ft. deep? How many loads? (A cubic yard is one load.)



9. How many square feet in the triangle *ABC*?

10. A schoolroom is 30 ft. long, 28 ft. wide, and 12 ft. high. It seats 40 pupils. What is the floor space allowed each child?

11. Find the area of a triangle whose base is 22 ft. 8 in., and whose altitude is 19 ft. 9 in.

12. My garden is 80 by 100 ft. What will a concrete walk around the inside border cost at $1.60 a square yard, the width of the walk being 3 ft.?

13. A grocer put up 12 lb. of pepper in 3-oz. packages, which he sold at 10¢ per package. How much did he receive?

14. A city map is drawn 600 ft. to the inch. What is the length of line which represents a street $1\frac{1}{2}$ mi. long?

15. Find the cost of a lot *a* feet wide and *b* feet long at $5 per square foot. Find the cost at *c* dollars per front foot.

16. How much will it cost to plaster the four walls and ceiling of a hall 60 ft. long, 36 ft. wide, and 18 ft. high at 45¢ per square yard, after deducting 486 sq. ft. for door and window openings?

17. If it costs $2 to transport 1000 lb. of wheat from St. Louis to New Orleans by water, how much will it cost at the same rate to transport 124.5 tons?

18. A room is 18 ft. wide, 21 ft. long, and 12 ft. high. Find the cost of lumber to line the walls at $4.50 per 100 sq. ft. Find the cost of plastering the ceiling at 75¢ per square yard.

19. The circumference of a redwood tree is 71 ft. What is its diameter?

20. The snowfall is 15 in. deep. How many cubic feet of snow on the flat roof of a schoolhouse 125 ft. by 75 ft.?

21. Make a drawing (scale $\frac{1}{16}$ in. to the foot) to represent the yard of a house. The lot is 64 ft. wide with a depth of 96 ft. The house, 32 ft. wide, and 48 ft. from front to back, is placed 32 ft. from the sidewalk. A walk 4 ft. wide leads from the house to the sidewalk.

22. Find the cost of cement work for the walk (problem **21**) at 24¢ per square foot.

23. Find the cost of grading and sodding the lawn in front of the house in problem **21**, at 30¢ per square yard.

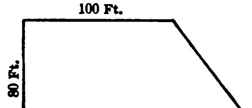
24. At 75¢ each, what will be the cost of a sufficient number of ties for one mile of railroad track, if 6 ties are required for each rod?

25. What is the cost of the flooring in a schoolroom 28 ft. wide by 32 ft. long at $120 per M?

26. A farmer sold 64 loads of oats, averaging 41 bu. 3 pk., at $.90 per bushel. How much did he receive?

27. A 56-acre field is 140 rd. long. How wide is it?

28. At $12.50 a cord, what is a pile of wood worth that is 16 ft. long, 8 ft. wide, and 4 ft. high?



29. Find the dimension not given in this diagram of a piece of ground.

30. A cow yields $1\frac{1}{2}$ gal. of milk a day. How much does the owner receive for the milk he gets in a week, if he keeps 3 pt. daily for his own use and sells the rest at 12¢ a quart?

31. If the moon's path is the circumference of a circle whose radius is 60 times the radius of the earth (4000 miles), how many miles does the moon travel in one revolution? (Make a diagram.)

32. Find the cost of laying a roadbed of crushed stone 1 mi. long, 16 ft. wide, and 6 in. deep, at 9.5¢ per cubic foot.

33. A rectangular block of stone contains 182 cu. ft. It is 4 ft. wide and $3\frac{1}{2}$ ft. thick. How long is it?

34. How many yards of leather upholstering 54 in. wide must be purchased for 20 footstools, if it takes a piece 12 in. square for each stool?

35. The diameter of a drumhead is 2.5 ft. How many square feet of skin are in the two heads?

36. A half-mile of 60-foot street is paved with wooden blocks. How many will be required at the rate of 36 blocks to a square yard?

37. What is the cost of plowing and harrowing a field 78 rd. long and 40 rd. wide at $7.50 per acre?

38. The diameter of a bicycle wheel is 28 in. How far does the bicycle go in 20 revolutions of the wheel?

39. A railway station in Peru is 16,635 ft. above the sea level. This altitude is how much more than three miles?

40. A grocer buys oil at 16¢ a gallon, and sells it at 7¢ a quart. How much does he gain on 2 bbl. of 42 gal. each?

*41. Work on the Cape Cod Canal was started June 21, 1909. The canal was opened July 29, 1914. Exactly how many days were there between the starting of the work and the opening?

*42. In a certain school there are 720 pupils. During a term, each pupil uses, on the average, 5 pens, which he purchases at a neighboring drug store at a cent each. What is the druggist's profit if he pays $1.00 a gross for the pens?

CHAPTER XII. REVIEW: STUDIES IN HOME ECONOMICS, AGRICULTURE, AND OTHER INDUSTRIES

53. Buying Food

The food for a family should include each day:

Milk. Every child under sixteen should have at least a pint a day, either fresh, or cooked in his food.

Cereal products, such as bread, rice, macaroni, and oatmeal.

Fruits and vegetables, such as apples, oranges and bananas; and lettuce, spinach, carrots, stringed beans, onions, and squash.

Meat, fish, eggs, or cheese. The more milk served, the less of these foods is required. Serving any one of these once a day is enough.

Additional fat and sugar are used by most families: such fats as butter, oleomargarine, lard, or oil; and such sugar as ordinary sugar, molasses, maple syrup, or corn syrup.

[Use pencil only when needed.]

1. Out of each dollar spent for food, it is a good rule to spend 25 cents for bread, cereals, and other grain foods; 20 cents for fruit and vegetables; 20 cents for milk; 20 cents for meat, fish, and eggs; and the remaining money for fat, sugar, and such groceries as baking powder, spice, etc. Express these proportions as per cents. As fractional parts of a dollar.

2. Following the rule given in problem 1, what is the approximate amount that should be spent for fruit and vegetables out of an expenditure for food of $15 a week? Of $16 a week? Of $20 a week?

3. The mother of a family finds when she made up her accounts for the week that she has spent $18 for food. She has spent the following amounts for fruit and vegetables: 1 lb. onions, $.06; 1 bunch celery, $.33; 1 cauliflower, $.25; ½ peck of potatoes, $.26; 1 can of tomatoes, $.24; 1 peck of spinach, $.19; 2 lb. carrots, $.07; 2 baskets of grapes, $.70; ½ peck of apples, $.40; 2 lb. dried peaches, $.50; 1 doz. oranges, $.60. What was the total amount spent for fruit and vegetables? What per cent of her total food bill was this?

4. According to the rule given in problem 1, which items in the following account should be greater? Which should be less? Total amount spent for a week's supply of food, $16.80. Out of this sum $2.14 is spent for milk; $3.20, for vegetables and fruit; $4.50 for meat; $4.20 for bread and cereals; and $2.10, for other food.

5. Milk is one of the best foods. A boy's gymnasium teacher noticed that he was under weight and that he had gained only a half pound in 10 months. The boy promised to drink a quart of milk a day in addition to his other food. During the summer vacation of 2 months, he gained 2 pounds; during the next school year of 10 months, 7 pounds. His average monthly gain was how many ounces during the first ten months? During the summer vacation? During the second school year?

6. Make a graph of the record of increase of weight given in problem 5, using a line $\frac{1}{8}$ of an inch long to stand for a gain of $\frac{1}{5}$ of an ounce. How long a line should be used for each of the three periods named?

7. The three children in a family were given $1\frac{1}{2}$ pints of milk in cocoa for breakfast, 3 pints in corn chowder for dinner, and 1 glass ($\frac{1}{2}$ pint) a piece to drink with their supper. How much milk was taken by the three children? This was how many pints for each child? How many glasses for each (a glass equals $\frac{1}{2}$ pint)?

8. An adult should consume each day 5 pints of water. One third of this amount is taken in the food. How many glasses of water, if each holds $\frac{1}{2}$ pint, should he drink each day?

9. A family of 5 people had been using 3 lb. of butter a week, eating $\frac{2}{3}$ at the table and $\frac{1}{3}$ in the cooking. The mother decided to use oleomargarine in the cooking instead of butter. With butter at 74¢ a pound and oleomargarine at 36¢, how much would she save in a week? How much would she save in a year?

10. What are the prices of butter and oleomargarine at your market this week? How much would the family save at these prices?

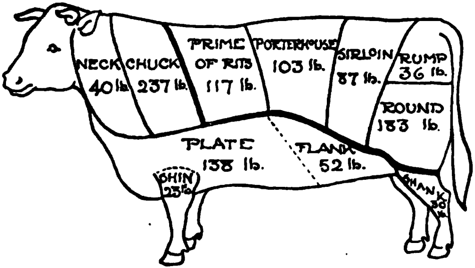
11. A pound of bacon cost 55¢. When it was cooked $\frac{5}{6}$ lb. of fat cooked out. If this fat were thrown away, what was the cost of the cooked bacon per pound?

12. Compute the cost of the following recipe for dropped molasses cookies: $\frac{1}{2}$ cup sugar, \$.025; $\frac{1}{2}$ cup molasses, \$.026; $\frac{1}{4}$ cup crisco, \$.043; 1 egg, \$.052; 1 teaspoonful ginger, \$.004; 1 teaspoonful cinnamon, \$.002; 1 teaspoonful salt, \$.0003; $1\frac{3}{4}$ teaspoonful soda, \$.001; $2\frac{1}{2}$ cups flour, \$.035. This receipt makes 28 large drop-cookies. What is the cost per dozen?

13. If molasses drop-cookies at the bakery cost 20¢ a dozen, how much does the mother of the family save when she makes the above receipt? (See problem 12.)

*14. Make and solve a problem like problem 4, using the actual amounts spent by your own or some other family.

II. BUYING CUTS OF BEEF



[With pencil.]

1. Find the total number of pounds in the various cuts of beef in the illustration; this will give the dressed weight of the animal.

2. The more expensive cuts are the prime of rib, porterhouse, sirloin, rump, and round. What per cent of the dressed weight do these cuts make?

3. Find from your local butcher[1] the price of each of these cuts per pound. What is their average price?

4. The less expensive cuts are the neck, chuck, plate, shin, flank, and shank. These are used for hamburg steaks, stews, soups, and mincemeat, and for corning. Find from your local butcher the price of each of these cuts per pound. What is their average price per pound?

5. Using the average prices of the expensive and the cheaper cuts (problems 3 and 4), find how much a family that uses 175 lb. of beef a year would save by buying cheaper cuts for one half of their supply.

54. Profitable Farming

The farmers of to-day are giving the most careful attention to the fertility of the soil, the quality of seed, the rotation of crops, the destruction of insects and diseases, and the latest machinery, so that their farms may produce their full value. Almost every state maintains a department where experiments are being made to help the farmer. Where is the State Experiment Station in your state?

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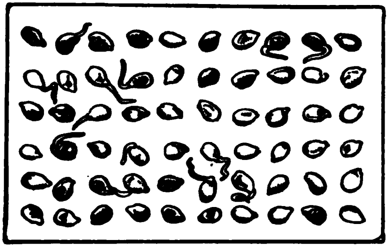
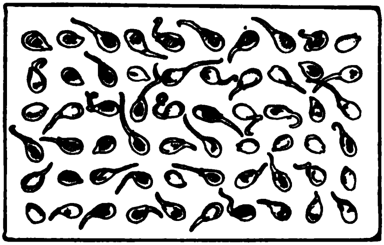
[1] As previously suggested, this information may be obtained by all the members of the class making inquiries, or by a committee appointed to call upon a butcher for the purpose.

I. Seed Tests

All progressive farmers are now taking a keen interest in obtaining the best seed, since the use of sound, pure, clean, vigorous seed has been found to increase the crops very materially. The use of poor seed is to a considerable extent responsible for the weed problem.



Sample 1



Sample 2

[With pencil.]

1. A farmer sent two samples of watermelon seeds to be tested at a State Experiment Station. The samples shown in the illustration were tested for germination under the same conditions. What per cent of the seeds in sample 1 had germinated? In sample 2?

2. In a test for germination, the United States Department of Agriculture found that seeds in bulk average 81.47% in germination, while seeds in packets average only 55.62 %. Make a problem based on the result of this test.

Four different samples of red clover seed that were tested showed the results indicated in the following table. Since the per cents given in columns 3, 4, and 5, opposite each kind of seed, will together equal 100%, how can the missing per cents in the table be found?

1 Trade Name	2 Price paid per Bushel	3 Per cent pure	4 Per cent Inert Matter	5 Per cent Weed Seed	6 Per cent Germination
"High Grade"	$20.00	98.5	0.93	0.57	71.5
"Very Choice"	16.00	76.03		13.09	23.00
"Country Prime"	16.75		0.30	0.53	92.5
"Best Grade"	18.00	99.45	0.55		94.0

Results of Seed Test
Showing that neither name nor price always indicates quality

3. "Very Choice" showed what per cent of "inert matter" (grit, chaff, stems, leaves)? "Country Prime" was what per cent pure? "Best Grade" contained what per cent of weed seed?

4. How much money would you have to spend to get a bushel of pure seed, if you purchased "Very Choice"?

Let x = cost of 1 bu. of seed 100% pure.
$76.03 : 100 = 16 : x$.

Solve by proportion:

5. How much money would you have to spend to get a bushel of pure seed if you purchased "Best Grade"?

6. In a pound of "Very Choice" there were 56,070 weed seeds. At the same rate, how many weed seeds in a pound of "Country Prime"?

7. About twenty ears of the best seed corn should produce seventy bushels. At $1.25 a bushel, each good seed ear will produce what value?

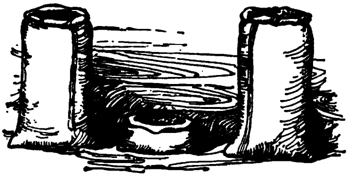
II. FERTILIZERS

Most of the necessary food elements are present in abundance in the soil. Nitrogen, phosphorus, and potash, however, which are required by wheat and most other crops, are usually found in the soil in only small amounts. Hence, after a few crops have been raised, these elements seem to become exhausted; and, in order to produce satisfactory results, it has been found good practice to add these food elements to the soil in the form of fertilizers.

[With pencil.]

1. A farmer who had 180 acres sown in wheat increased the yield 8.6 bu. per acre by the use of fertilizers. The cost of the fertilizers was $5.70 per acre. If wheat sold for $2 per bu., by how much was his return increased by fertilization? Express this increased return both as dollars and cents and as a per cent of the cost of the fertilizers.

The illustration below shows the relative yield per acre from three different wheat farms:



1	2	3
21.3 bu. per A.	4.2 bu. per A.	22.6 bu. per A.
Nitrogen, 60 lb. per A.	Not fertilized	Acid phosphate 200 lb. per A.
Acid phosphate, 200 lb. per A.		Muriate of potash 30 lb. per A.

2. If nitrogen cost 20¢ per pound; acid phosphate, $1\frac{1}{2}$¢; and muriate of potash, 4¢, which farm realized the greatest profit per acre from the use of fertilizers, with wheat selling at $2 per bushel?

3. A farmer applied at seeding time 500 lb. of fertilizer to the acre. He mixed the fertilizer himself, so that it cost him only $40 per ton. If he fertilized 147 acres, how much did the fertilizer cost? If he saved $1.25 per acre by mixing the fertilizer himself, how much did he save in all?

4. In one of the states there are about 2,500,000 acres of wheat grown each year. The average yield for the past 20 years has been about 14 bu. per acre. 28 bu. of wheat per acre have been raised. If this yield could be produced throughout the state, how much greater would be the income from the crop, when wheat brings $2.00 a bushel?

*5. Fertilized soil sown to wheat continuously for a number of years produced 21 bu. per acre. Fertilized soil that raised in rotation corn, oats, wheat, and clover, produced 24.2 bu. of wheat per acre. At $2 per bushel, how much greater gross income would the increase yield, in the case of a 27-acre field?

III. THE DAIRY

Cows yield from 2500 to 20,000 pounds of milk in a year. It costs from $60 to $140 a year to feed a cow. The value of the calf and of the manure, which is returned to the soil to keep up the fertility of the land, is usually about one half of the cost of the labor in caring for the cow.

The quality of milk is judged by the amount of fat it contains; this may vary from 2.5% to 8% or more. Cream may contain from 15% to 60% fat, depending upon the quality of the milk from which it is obtained and the amount of milk left in it. Cream for table use should contain from 18% to 25% of fat.

Butter is made from the fat of cream, together with a little water, salt, and curd. According to the law of some states, butter must not contain more than 16% water. The amount of butter obtained in excess of the amount of butter fat in the cream is called "overrun," and depends upon the amount of water and salt added.

Cheese contains the casein or curd of milk, together with the fat, small amounts of other solids of milk, and some water.

[With pencil.]

1. A cow yields annually 8000 lb. of milk, which tests 4% fat. How much fat does she produce each year?

2. With butter at 50¢ a pound, how much will be received each year from this cow's butter (problem 1), if the overrun averages 15% of the total weight of the butter? (85% is butter fat; 15% is overrun.)

3. Nine pounds of cheese can be made from 100 lb. of this milk. How much more or less would the farmer have received, if he had made the milk into cheese that sells at 25¢ a pound, when the cost of making cheese is 1½¢ a pound?

4. It cost $100 a year to feed and care for this cow. The gross profit on the butter is what per cent of this cost? (See problem 2.)

5. If a quart of milk, which contains as much nutriment as 10 oz. of steak, worth 50¢ a pound, should be sold according to the same food value as steak, what price would be charged for it?

6. A milk dealer received in one month 257,395 lb. of milk, for which he paid 3.9¢ a pound. The cost of shipping, filtering, pasteurizing, bottling, and factory and office expense amounted to 15¢ per gallon. Milk weighs 8.5 lb. per gallon and sells at 15¢ per quart. How much did the dealer make or lose on his month's business?

7. Standardized milk is produced by mixing milks of varying fat contents until the desired fat content is obtained. If equal quantities of 3% milk, 5.2% milk, 4.3% milk, and 3.5% milk are mixed, what per cent of fat will the mixture test?

8. It costs $100 to feed a cow for one year. How much milk testing 4% will pay for her feed, if butter fat is worth 50¢ per pound?

9. A farmer has one cow that yields each year 4000 lb. of 5% milk; another that yields 8000 lb. of 3% milk. How much butter can be made from the milk of these two cows, if an average overrun of 15% is obtained in each case?

In an experiment to test the value of good feeding in the production of milk and butter, two cows were fed for 30 days on a good ration, and two other cows on a poor ration. Then, for the next month, the first two cows were fed the poor ration, and the other two cows the good ration. The cost of the two rations was practically the same. The results are shown in this table:

	GOOD RATION				POOR RATION			
	1 Milk lb.	2 Fat %	3 Fat lb.	4 Butter lb.	5 Milk lb.	6 Fat %	7 Fat lb.	8 Butter lb.
Cow No. 1	949.9	4.72	44.84	52.31	613.6	4.02	24.67	28.79
Cow No. 2	538.5	3.55	19.12	22.28	435.6	3.45	15.03	17.51
Cow No. 3	500.4	4.48	22.42	26.12	402.5	4.61	18.56	21.65
Cow No. 4	712.9	3.65	26.02	30.31	562.5	4.01	22.56	26.35

10. Find the difference between the total number of pounds in column 1 and column 5; in column 3 and column 7; in column 4 and column 8. Use each of these differences in a statement to compare the effect of the good and the poor ration.

IV. The Corn Crop

[With pencil.]

1. The total production of corn in the corn belt in a certain year was 1,620,000,000 bu. The total production of corn in the cotton belt was 706,000,000 bu. The corn produced in the cotton belt was what per cent of the corn produced in the corn belt?

2. The total production of corn in the United States during the same year (see problem 1) was 3,055,000,000 bu. What per cent of this total was produced in the corn belt and what per cent in the cotton belt?

3. There were 49,000,000 acres in corn in the corn belt and 34,000,000 acres in the cotton belt. What was the average number of bushels per acre in each belt (see problem 1)?

4. A farmer produces 50 bu. of corn per acre at a cost of 30¢ a bushel. What is his profit on 75 acres when corn is selling for $1.50 a bushel?

5. Another farmer produces 20 bu. per acre at a cost of 65¢ a bushel. What will be his profit on 75 acres when corn is selling at $1.50 a bushel?

6. In a certain year there were 2,672,804,000 bu. of corn produced in the United States; in other countries outside the United States 3,864,279,000 bu. were produced. What per cent of the total crop was produced in the United States?

7. A crib contained 35,625 lb. of corn in the ear; 80% of this was grain. How many pounds of grain were there? How many bushels of 56 lb. to the bushel were there in the crib?

8. A miller grinds 750 bu. in a day and his toll for grinding is 8 lb. per bushel. How much does he make when corn is $1.75 per bushel?

9. In a field there were 100,585 stalks of corn. It was found that 10% of the stalks were barren. If the corn on 75 stalks bearing ears produced a bushel, how many bushels did the farmer lose on account of barren stalks?

10. One year a farmer raised 75 acres in corn with 12,000 stalks per acre, and 100 ears to the bushel. The next year by careful selection of seed he was able to increase his crop by 25%. By how many bushels did he increase his crop by seed selection?

11. When a farmer and his team costs $5 per day and it takes a day to haul 35 bushels of corn to the mill, what is the cost per bushel of hauling the corn to the mill?

12. If it costs 5¢ a bushel to shell and sack corn and the sacks cost 7¢ each, what does it cost a farmer to shell and sack his crop of 9000 bushels, if each sack holds three bushels?

13. A farmer had in a pasture 45 hogs each weighing 75 lb. If he fed them 2% of this weight each day in corn, how many bushels of corn did they consume in 30 days?

14. A farmer produces 8 tons of corn silage per acre. How many acres are required to fill a 75 ton silo?

15. A farmer is feeding 25 cows from a 100 ton silo filled with corn silage, and each cow consumes 40 lb. of silage a day. How many days can he feed them?

16. If a man and his team are worth $5 a day and he gathers 75 bushels of corn a day, what is the cost per bushel for gathering corn?

17. A bin contains 500 bu. of corn. It costs $3 to fumigate the bin with carbon-bisulphide to destroy corn weevil. Without fumigating the loss would have been 25% of the corn. What was the cost per bushel for fumigating? How much would a farmer save by fumigation when corn is selling at $1.50 a bushel?

18. A farmer who was producing 17 bu. of corn per acre found that it cost 65¢ per bushel to raise it. If he had produced 60 bu. per acre the cost would have been reduced to 30¢ per bushel. What was the difference in profit per acre when corn was selling for $1.50 a bushel?

19. A bushel of corn contains 1 lb. of nitrogen. How many pounds of nitrogen will be taken from the soil of an acre that produces 56 bushels of corn?

20. What is the amount of nitrogen required to produce 42 bu. of corn per acre on a 14-acre field?

21. How much nitrogen was taken in eight years from the soil of an acre of land that produced an average of 36 bu. of corn per year?

22. A ton of clover hay contains 40 lb. of nitrogen. In a 3-year rotation of corn followed by clover and again by corn, in which the clover hay is plowed under, what will be the gain or loss in nitrogen per acre with an average yield of 3 tons of clover and 27 bu. of corn?

23. Cowpea hay contains 43 lb. of nitrogen a ton. What is the gain or loss in nitrogen when a farmer grows cowpeas with his corn and plows the cowpeas under, if the yield of cowpeas is 2 tons per acre and the corn 47 bu.?

24. A bushel of corn (grain) contains .17 lb. of phosphorous. The grain and stalk contain .23 lb. of phosphorous. How much phosphorous is taken from the soil per acre that produces 60 bu. of corn, if the stalks are plowed under?

25. What amount of phosphorous per acre is taken from soil that produces 46 bu. of corn, if the stalks are removed from the land?

26. A bushel of corn (grain) contains .19 lb. of potassium. The grain and stalks contain .71 lb. of potassium. How many pounds of potassium per acre are removed from soil that produces 26 bu. of corn if the stalks remain on the land?

*27. How much nitrogen, phosphorous, and potassium per acre will be removed in 3 years from soil that produces 38 bu. of corn per acre, if the stalks remain on the land?

*28. What is the value of each of the plant food elements consumed in problem 27, if nitrogen is 30¢ a pound, phosphorous 8¢ a pound, and potassium 7¢ a pound?

V. CANNING CLUBS

[With pencil.]

1. A girl belonging to a canning club found that her garden was 132 ft. long. What must be the width of it to give her the required one tenth of an acre?

2. The rows are 3 ft. apart. How many rows will there be in the garden?

3. The plants are 2 ft. apart in the drill. How many plants will there be to each row and how many on the one tenth of an acre?

4. At this rate how many plants can be grown on an acre?

5. A two-horse plow can break two acres in one day of ten hours. How many hours will it take to break one tenth of an acre?

6. At 10¢ per hour for each of two horses and 40¢ per hour for the man, how much will it cost to break the one tenth of an acre?

7. If a hot-bed 5 ft. 9 in. wide and 6 ft. long will grow enough tomato plants for one tenth of an acre garden, what would be the area of a hot-bed that would grow enough plants for 1 acre?

8. A canning-club girl applied to her one tenth of an acre 10 pounds nitrate of soda which cost $80 per ton; 30 pounds of acid phosphate which cost $20 per ton; and 15 pounds of muriate of potash which cost $100 per ton. What was the cost of the fertilizer applied to the one tenth of an acre?

9. If the nitrate of soda contained 15% nitrogen, the acid phosphate 16% phosphoric acid, and the muriate of potash 50% potash, how many pounds of these plant food elements were applied in each fertilizer used by the girl (see problem 8)?

10. The cost of production for the one-tenth acre was $20.10 and the cost of canning and supplies $73.30. The total value of all the products was $246.05. What net profit for the year did the canning-club girl make from her one-tenth acre?

11. The contents of a No. 2 can of tomatoes is $\frac{2}{3}$ as much as that of a No. 3 can. What amount will one receive for 360 No. 2 cans and 500 No. 3 cans, at $2.10 per dozen for No. 3 cans.

12. If it takes 1 lb. of copper sulphate, 1 lb. of quicklime, and 10 gal. of water to make enough Bordeaux Mixture to spray once one tenth of an acre, how much of the first two would you buy for five sprayings for a whole acre?

13. If 5% of the plants on the one-tenth acre in problem 3 had tomato wilt and were pulled up and burnt, and 10% had blossom end rot so badly that they produced no tomatoes, but the rest were sprayed with Bordeaux Mixture and saved, how many plants were sprayed?

14. It takes $1.65 worth of copper sulphate and lime to spray one tenth of an acre five times, and the sprayer costs $5. A canning-club girl by spraying her plants saved 20 bushels of tomatoes. How much did she save by spraying if she sold her tomatoes at $1.50 per bushel?

15. Ten girls having a summer garden cleared $52.50 each. Five of these girls grew a winter garden, thus increasing their profits 25%. How much more did each of these five girls earn than each of the other girls?

16. A club girl needs 3 yd. of white material for her apron, ½ yd. of the same for the brim of her cap, and ½ yd. of dotted swiss for the crown of her cap. White percale or cambric is 18¢ per yard and dotted swiss is 25¢ per yard. How much does her cap and apron each cost?

*17. If a canning-club girl buys 500 tin cans at $46.00 per M and borrows the money from a bank at 8% interest for six months, how many cans of tomatoes at $2.10 per dozen does she have to sell to pay the bank the amount she owes?

*18. A club of girls decided to buy together supplies for 12 fireless cookers consisting of 12 lard tubs at 15¢, 8 sheets of asbestos paper at 10¢, 12 2½-gallon lard buckets at 35¢, 12 soapstones at 40¢, and 12 6-qt. clamp top boilers at 35¢. How much did each girl's fireless cooker cost?

VI. RAISING POULTRY

1. What will it cost to have 75 broilers dressed for market if one broiler can be dressed in 4 minutes and the picker charges 75 cents an hour?

2. In a flock of 1000 hens, 40 were lost by disease. What was the per cent of deaths?

3. A boy belonging to a poultry club sold to a grocer 30 doz. eggs at 60¢ a dozen, and 6 surplus cockerels weighing respectively 8, 6½, 7½, 9, 7, and 8½ pounds at 25¢ a pound. With his money he bought a pair of shoes at $7.50, and a cap at $1.00. How much money had he left to deposit in the bank?

4. How many cases holding 30 dozen eggs will a flock of 150 hens fill in a year, each hen averaging 160 eggs a year?

5. How much will be received in a year from 2375 hens each laying an average of 151 eggs with eggs selling at 35 cents a dozen?

6. A club of six boys in a year sold enough eggs coöperatively to amount to $1300. If one member contributed 400 dozen, another 500 dozen, another 200 dozen, another 600 dozen, another 800 dozen, and another 300 dozen, how much money was due each member?

7. What will be the cost of making the following powder if plaster of paris costs 10¢ a pound, crude carbolic 50¢ a quart, and gasoline 25¢ a gallon?

Lowry's lice powder
$2\frac{1}{2}$ lb. plaster of paris
$\frac{1}{4}$ pt. of crude carbolic
$\frac{3}{4}$ pt. of gasoline

8. A boy kept 200 dozen eggs in water-glass till November and then sold them for 17¢ a dozen more than he would have received if he had sold them when fresh-laid. How much more did he receive for them than if he had sold them when fresh-laid?

9. It is estimated that the annual poultry crop of the United States is worth $600,000,000 and that $45,000,000 is lost yearly from bad eggs. What per cent of the yearly crop is the loss from bad eggs?

10. 240 eggs were put in an incubator. When tested on the seventh day there were 20 infertile; on the fourteenth day there were 5 dead germs and 10 rots; on the twenty-first day there were 5 chicks too weak to break the shells. If the rest of the eggs hatched, what per cent hatched?

11. If it requires 10 lb. of rape seed to plant an acre (43,560 sq. ft.) of land broadcast, how much seed will be required to plant a plot of ground 20 ft. by 30 ft. for back yard poultry?

12. Three flocks of 75 hens each were fed in three different ways and produced the following number of eggs:

Pen No. 1 fed buttermilk, produced	1762 eggs.
Pen No. 2 " beef scrap, "	1625 "
Pen No. 3 " no meat and no milk, produced	730 "

How much larger return did the first ration bring in than the third, if the eggs were sold for 45 cents per dozen?

13. When eggs were 45 cents per dozen, a poultry club found that by grading their eggs and selling coöperatively they could get on the average 2½¢ a dozen over the market price. How much did they gain on 10 thirty-dozen egg cases?

14. How much floor space will be needed in a house built for 150 hens, if 4 sq. ft. is required for one hen?

15. How many perches 8 ft. long will be required for a flock of 144 fowls if each bird requires 10 in. of space?

16. When wheat bran is $3.00, shorts $3.00, and beef-scrap $3.50 per 100 lb., what will the following ration cost? (The charcoal and salt cost 20¢.)

400 lb. wheat bran
150 lb. wheat shorts
100 lb. beef-scrap
4 lb. fine charcoal
3 lb. fine salt

***17.** How many bales of oat straw will be needed for the litter 1 ft. deep in a chicken house 8 ft. by 8 ft., if one bale covers 64 sq. ft. 6 inches deep?

***18.** What will be the annual cost of litter for 10 chicken houses 8 ft. by 8 ft., if one bale of hay costs 25 cents and the litter is changed every two months (see problem 17)?

VII. Irrigation

I

In certain parts of western United States, the rainfall is insufficient to grow crops successfully. To make these sections productive, the United States Government builds great reservoirs near rivers and streams to hold the water. This water is distributed as needed, through canals and ditches, to the crop-growing districts.

1. In a recent year there were 1,797,800 acres of land under irrigation. This area is how many times that of Rhode Island, which contains 4965 square miles?

2. To distribute the water, 10,000 miles of canals have been dug. How many times would these canals, if built in a straight line, reach across the United States, a distance of 3000 miles?

3. The construction of the Salt River irrigation system in Arizona cost $14,938,400. It irrigates 192,077 acres. What was the average cost of the construction per acre?

4. In a single year the total value of the crops raised on the land reclaimed by the Salt River system (problem 3) was $13,692,000. What per cent of the cost of construction was this amount?

II[1]

The water from the irrigation ditches is turned on to the land only as needed and those using the water pay for the amount used. The quantity used is commonly measured by the "second-foot" and the "acre-foot."[2]

A second-foot is one cubic foot of running water passing a given point in one second.

An acre-foot is the volume of water required to cover one acre of land to the depth of one foot.

*1. Prove that an acre-foot is equal to 43,560 cu. ft. of water.

*2. Show that a second-foot of water, running for 43,560 seconds, equals one acre-foot.

---

[1] This section is intended for those pupils only who live in parts of the country directly interested in irrigation.

[2] The "miner's inch," also commonly used, was first used in gold mining. It is about $\frac{1}{40}$ of a second-foot, varying slightly in different states.

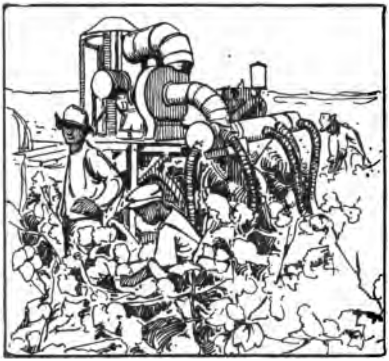
*3. How many hours would it take to cover an acre of alfalfa land with water one foot deep? 4 inches deep?

*4. A farmer orders 3 second-feet of water for 10 hours. At $1.50 an acre-foot, what will be the charge for the service?

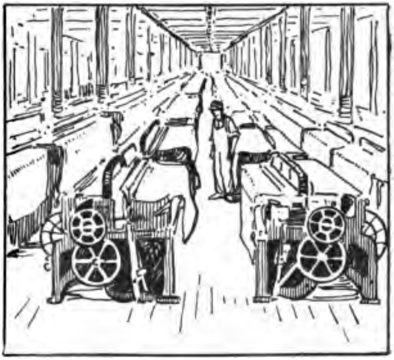
*5. Mr. Sutton used last season 2 acre-feet of water per acre on his 40 acre tract of wheat land. How much did the water cost him at 80¢ an acre-foot?

*6. Harold Allen has a four-acre field in which he plants alfalfa. He pays $4.00 per acre for plowing, $3.00 per acre for drilling the seed and for other labor and expenses. He uses $\frac{1}{4}$ acre-foot of water at $1.60 per acre-foot twice during the season for irrigation. If he raises 7 tons of alfalfa and sells it for $18 a ton, what is his profit?

55. The Cotton Industry



Picking Cotton



Looms in a Cotton Mill

I. PRODUCTION

[With pencil.]

1. In a recent year the United States produced 13,696,000 bales of cotton. The estimated production for the entire world that year was 21,817,000 bales. What per cent of the total supply of cotton was produced in this country?

2. In 1850 there were produced in this country 2,454,442 bales of cotton. Express decimally the ratio of the number of bales produced in 1850 to the number produced in the year referred to in problem 1?

3. A bale of cotton usually weighs about 500 lb. Find the value of the cotton crop of 13,696,000 bales, of 500 lb. each, at 25¢ a pound.

*4. If the fertilizer for a cotton field cost $7 per acre, the plowing and cultivating $10 per acre, the picking of the cotton $5 per acre, and the ginning and baling $5.00 a bale, what would be the total cost of the production of a 500-pound bale when an acre yields a half bale of cotton?

*5. Cotton seed is a valuable by-product from cotton production. At 2.50 a hundredweight, how much would be received for 5040 lb. of cotton seed produced from a 10-acre crop?

II. MANUFACTURE AND SELLING

[With pencil.]

1. The cost for freight in shipping cotton from New Orleans to a cotton mill is 65¢ per hundredweight in carload lots. How much would the freight bill amount to for a carload of cotton containing 45 bales?

2. At 25¢ a pound, what would be the amount of the bill for a carload of cotton (problem 1), excluding freight?

3. The finest grade of cotton, called Sea Island Cotton, comes from the Sea Islands off the coast of the South Atlantic States. It is packed in bags containing 150 lb. each. At 60¢ a pound, what would be the cost of 12 bags? How much more would this cotton cost than the same amount of cotton selling at 25¢ a pound?

4. In a cotton mill where "print cloth," or ordinary calico, is manufactured, there are 1200 looms weaving the cloth. If each loom runs on the average 160 "picks" to the minute and there are

64 picks to each inch of cloth, how many yards of cloth would be turned out by the mill in an eight-hour day, deducting 7½% for the stopping of looms to pick up broken threads and to make repairs?

5. What would be the total output of this mill in a week of 48 working hours?

6. When the average net profit on each loom is $1.50 a week, how much per yard must be added to the actual cost of the cloth to give this net profit? Find the total net profit of the mill for a year.

7. The capital invested by the owners of the mill is $1,000,000. What per cent of the capital is the net profit?

8. The cost of the mill is made up of $350,000 in real estate and buildings, and $650,000 in machinery and other equipment. What sum of money must be set aside each year to allow 5% of the cost of the machinery and equipment for buying new machinery, and 3% of the cost of the real estate and buildings for repairs and depreciation?

9. The mill is insured for its full value in a mutual company, at a rate of ¾ of 1% per year. Since it is a mutual company, however, 85% of the premium is returned at the end of the year. Find the yearly cost of insurance, including interest on the premium at 5%.

*10. To get this low rate of insurance (problem 9) the mill, among other equipment, must have near at hand a reservoir containing 100,000 gal. of water. The reservoir built for this purpose is 50 ft. in diameter. What depth of water must be maintained in it (231 cu. in. to the gallon)?

11. The employees of this mill are a superintendent, whose salary is $6000 a year, 7 overseers, who receive an average wage of $50 a week, and 473 employees, whose wages average $20 a week. Find the amount of the weekly pay roll.

12. A boy starting to work in this mill at 16 years of age receives $8 a week. If he develops unusual skill, he may, at the age of 25,

earn $40 a week as a "mule spinner." Should he be so successful as this, what would have been his average yearly increase in income for the 12 years?

*13. From the cotton mill, the cloth goes to the "printer," who prints the design or pattern on the cloth. If the cloth before printing is sold for 11¢ a yard, and 7 yd. of the goods weigh a pound, find how much the manufacture of the cloth has cost (including the manufacturer's profit), when the cotton of which the cloth is made cost 25¢ a pound.

*14. After the cloth is printed, it goes to the wholesaler, who, in turn, sells it to the retailer. If the printer receives 1⅛¢ a yard for printing, and the wholesaler also receives 1⅛¢ a yard, what per cent of gross profit on the cost does the retailer make when he sells the cloth at 20¢ a yard?

56. The Manufacture of Railway Locomotives

[Use pencil only when needed.]

1. One of the largest plants in the United States for manufacturing locomotives consumes, on an average, 4200 tons of coal a week. What is the company's coal bill per week if 90% of the coal used is soft coal at $2.85 a ton; 3% of it hard coal at $5.95 a ton; and the rest buckwheat coal at $3.40 a ton? What is the total expenditure for coal per week? Per year?

2. The company used in one week 1800 tons of pig iron at $28 a ton, 180 tons of bar iron at 2½¢ per pound, and 4500 tons of steel at 2.4¢ per pound. What was their total expense for iron and steel for the week? At the same rate, what would be the cost of a year's supply? (Pig iron is sold at 2240 lb. to the ton; bar iron and steel, at 2000 lb. to the ton.)

3. Thirty-two boilers, averaging 400 horsepower each, produce the steam required for generating the electricity for lighting the plant and for power. What is the total horsepower produced?

4. It took this plant nearly a year to build their first locomotive. How many locomotives do they now build in a year at the rate of 9 per day, Sundays excluded? (Allow for 52 Sundays in the year.)

5. The weight of a locomotive built by this company is 180,000 lb. on the driving wheels, 52,000 lb. on the front truck, and 57,000 lb. on the trailing wheels. How many tons does it weigh?

6. The cost of a locomotive is about 18¢ a pound. Find the cost of the locomotive referred to in problem 5.

57. Study of Local Industries

Visit some of the leading local industries and business houses, or, if in a rural community, study some of the various branches of agriculture, to obtain facts and figures for problems. Bring these problems to class and have them solved by your classmates after you have first explained how the industry or business is carried on. You will thus be helping yourself and your classmates, not only to become intelligent about local enterprises, but also to prepare for successful business careers.

ARITHMETICAL GYMNASIUM

Graded Practice for Skill in Computing [1]

Use these exercises to overcome any weaknesses in the essential processes and to strengthen your ability in computing accurately and rapidly.

I Addition

A. Practice on each of these exercises until you can add the columns within the time limit. Add at a steady rate.

1. Time limit, 18 to 22 seconds.

5	6	8	6	7
3	5	4	0	8
4	0	6	8	6
5	7	8	6	7
7	8	9	7	9

2. Time limit, 38 to 45 seconds.

6	8	9	5	7
7	6	7	9	2
0	7	8	2	7
5	9	8	7	8
6	5	0	3	1
9	7	9	9	6
3	4	5	6	8

3. Time limit, $1\frac{1}{2}$ to 2 minutes for 5 problems.

5	8	6	7	6	4	9	4	6	5
6	0	8	9	8	4	0	7	8	7
8	6	0	6	7	9	7	9	5	6
7	5	7	7	8	6	9	8	6	7
0	4	5	4	7	4	5	6	7	5
7	8	9	5	9	7	6	6	7	6
8	7	6	8	6	9	8	8	5	9
9	6	4	6	6	8	9	3	6	8
6	5	8	0	8	8	5	9	8	4
8	2	6	7	9	5	9	6	2	5
6	8	9	9	8	9	3	6	9	6
9	7	8	7	5	6	7	9	3	7

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[1] For directions for using these exercises, see page 37.

Add rapidly but carefully.

B. Time limit, 3½ to 4 minutes for 5 problems.

1.	2.	3.	4.	5.
347	765	354	876	872
838	588	546	566	698
207	375	399	342	869
568	677	589	877	413
378	885	755	939	678
587	758	456	878	879
935	999	473	235	456
289	378	908	792	238
356	485	599	969	787

6.	7.	8.	9.	10.
485	827	854	941	730
448	796	649	182	603
857	728	750	750	377
565	380	385	785	972
370	238	968	856	989
689	646	526	967	439
905	957	847	398	795
356	569	856	881	897
587	478	729	577	369

C. Time limit, 4½ to 5½ minutes for 4 problems.

1.	2.	3.	4.
98 756	848 369	8 924	432 567
84 005	75 824	9 765	97 824
39 524	39 655	89 765	38 978
63 875	875 399	8 344	4 863
9 846	678 388	104 732	98 755
34 858	397 404	338 657	604 328
287 655	300 978	87 928	397 875
153 789	86 938	439 658	975 987

Add, reducing answers:

D. 1.	2.	3.	4.	5.	6.	7.
$\frac{2}{7}$	$\frac{2}{9}$	$\frac{7}{12}$	$\frac{5}{16}$	$22\frac{1}{6}$	$15\frac{1}{4}$	$42\frac{5}{8}$
$\frac{1}{7}$	$\frac{1}{9}$	$\frac{1}{12}$	$\frac{8}{16}$	$4\frac{1}{6}$	$7\frac{1}{4}$	$16\frac{1}{8}$

Add, reducing answers:

E.	1.	2.	3.	4.	5.	6.	7.
	$\frac{4}{5}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{11}{12}$	$12\frac{5}{6}$	$22\frac{7}{8}$	$31\frac{11}{12}$
	$\frac{3}{5}$	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{7}{12}$	$4\frac{1}{6}$	$4\frac{5}{8}$	$14\frac{5}{12}$

F.	1.	2.	3.	4.	5.	6.	7.
	$\frac{1}{4}$	$\frac{2}{9}$	$\frac{1}{4}$	$\frac{1}{2}$	$17\frac{3}{8}$	$14\frac{2}{3}$	$10\frac{7}{12}$
	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{5}{8}$	$\frac{5}{12}$	$5\frac{1}{2}$	$8\frac{1}{12}$	$6\frac{1}{4}$

G.	1.	2.	3.	4.	5.	6.	7.	8.	9.
	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{3}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{5}{12}$	$\frac{2}{3}$	$\frac{7}{12}$	$\frac{11}{14}$
	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{8}{9}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{2}{3}$	$\frac{5}{7}$

10.	11.	12.	13.	14.	15.	16.
$21\frac{7}{8}$	$14\frac{9}{16}$	$12\frac{2}{3}$	$21\frac{1}{2}$	$32\frac{3}{4}$	$16\frac{5}{12}$	$35\frac{2}{3}$
$22\frac{3}{4}$	$7\frac{5}{8}$	$31\frac{5}{6}$	$14\frac{9}{10}$	$24\frac{5}{12}$	$22\frac{5}{6}$	$21\frac{14}{15}$

H.	1.	2.	3.	4.	5.	6.	7.	8.	9.
	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{5}{6}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{1}{12}$
	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{2}{9}$	$\frac{1}{15}$	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{5}{8}$	$\frac{1}{15}$

10.	11.	12.	13.	14.	15.	16.
$13\frac{3}{4}$	$12\frac{1}{6}$	$34\frac{1}{6}$	$27\frac{1}{2}$	$18\frac{1}{2}$	$42\frac{3}{8}$	$28\frac{1}{6}$
$12\frac{1}{6}$	$17\frac{1}{9}$	$21\frac{3}{8}$	$16\frac{1}{3}$	$21\frac{2}{5}$	$26\frac{1}{3}$	$17\frac{1}{10}$

I.	1.	2.	3.	4.	5.	6.	7.	8.	9.
	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{5}{6}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{6}$
	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{7}{9}$	$\frac{5}{12}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{4}{5}$	$\frac{4}{5}$	$\frac{4}{15}$

10.	11.	12.	13.	14.	15.	16.
$16\frac{1}{2}$	$18\frac{1}{3}$	$29\frac{2}{3}$	$21\frac{1}{3}$	$28\frac{5}{6}$	$32\frac{3}{8}$	$48\frac{3}{10}$
$12\frac{4}{5}$	$17\frac{3}{4}$	$41\frac{3}{8}$	$12\frac{4}{5}$	$17\frac{5}{8}$	$27\frac{11}{12}$	$24\frac{5}{6}$

J. Write answers without copying numbers:

1. \$2.40 + \$3.50 = ?
2. \$5.30 + \$2.80 = ?
3. \$5.75 + \$3.21 = ?
4. \$4.84 + \$2.62 = ?
5. \$12.55 + \$14.69 = ?
6. \$4.30 + \$2.20 + \$3.40 = ?
7. \$2.70 + \$4.80 + \$6.40 = ?
8. \$3.75 + \$2.18 + \$4.34 = ?
9. \$12.16 + \$14.24 + \$8.75 = ?
10. \$25.75 + \$16.45 + \$18.65 = ?

Add by columns and then by rows across the page.[1]

K.	1.	2.	3.	4.	5.
6.	$728\frac{1}{2}$	$524\frac{1}{8}$	$428\frac{1}{5}$	$175\frac{5}{8}$	$274\frac{3}{8}$
7.	$316\frac{1}{2}$	$372\frac{1}{2}$	$394\frac{3}{4}$	$247\frac{1}{3}$	$475\frac{1}{5}$
8.	$740\frac{1}{4}$	$654\frac{5}{6}$	$682\frac{1}{2}$	$524\frac{5}{6}$	$84\frac{8}{10}$

L.	1.	2.	3.	4.	5.
6.	$16.75	$46.74	$214.98	$567.47	$8724.92
7.	48.24	38.96	769.49	389.69	2147.39
8.	9.67	17.98	398.78	692.94	6584.87
9.	15.80	38.64	699.89	87.86	698.75
10.	14.97	79.88	549.26	58.74	7008.96
11.	28.16	5.79	98.79	148.75	879.64
12.	94.78	9.87	248.75	304.65	5487.99

M. Express as decimal parts of a dollar and find answers:[1]

1. 18¢ + $4\frac{1}{2}$¢ + 9 mills = ?
2. 72¢ + $8\frac{1}{2}$¢ + $7\frac{3}{4}$¢ = ?
3. \$.04$\frac{1}{2}$ + \$.003 + $2\frac{1}{4}$¢ = ?
4. \$24$\frac{1}{2}$ + \$.03$\frac{1}{4}$ + $4\frac{1}{2}$¢ = ?
5. $3\frac{1}{4}$¢ + $\frac{1}{2}$¢ + 4 mills = ?
6. 7¢ + $2\frac{1}{4}$¢ + $5\frac{1}{2}$ mills = ?
7. $2\frac{1}{2}$ mills + $3\frac{1}{4}$ mills + $5\frac{1}{2}$¢ = ?
8. 7 mills + $2\frac{3}{4}$ mills + $4\frac{3}{4}$¢ = ?

N. Add by columns and then by rows across the page.[1]

	1.	2.	3.	4.	5.
6.	2.45	.475	24.63	214.32	48.63
7.	3.424	.389	8.75	678.9	79.62
8.	5.896	.674	19.634	875.874	87.496
9.	7.92	.8796	14.78	675.483	39.875
10.	9.745	.0045	39.695	48.97	9.76

O. Change each fraction in Exercise K to a decimal, and add the numbers first by columns then by rows across the page.

---

[1] Before adding by rows the problems should be copied in column form.

II. SUBTRACTION

A. Subtract, naming differences only. Time limit, 2 to 3 minutes.

1. 87649	2. 174235	3. 156543	4. 287643	5. 163776
24835	93706	70898	99867	87017

6. 539645	7. 329654	8. 695437	9. 925467	10. 132577
42074	78280	74278	68059	53039

B. Subtract. Time limit, 2 to 3 minutes.

1. 40700	2. 51030	3. 80900	4. 62040	5. 50000
21310	22027	32741	32794	13248

6. 40300	7. 50080	8. 70300	9. 60009	10. 82030
13188	14246	35720	15234	14079

Subtract, reducing all answers:

C.	1. $\frac{4}{5}$	2. $\frac{3}{4}$	3. $\frac{7}{8}$	4. $\frac{7}{9}$	5. $\frac{11}{12}$	6. $28\frac{3}{4}$	7. $16\frac{5}{7}$	8. $16\frac{3}{8}$	9. $14\frac{11}{12}$
	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{12}$	9	$6\frac{2}{7}$	$2\frac{1}{8}$	$8\frac{1}{12}$

D.	1. 18	2. 25	3. 37	4. 24	5. 40	6. 90	7. 75
	$4\frac{3}{4}$	$2\frac{2}{5}$	$6\frac{7}{8}$	$16\frac{2}{3}$	$37\frac{1}{2}$	$83\frac{1}{3}$	$14\frac{2}{7}$

E.	1. $6\frac{1}{3}$	2. $8\frac{1}{4}$	3. $7\frac{2}{5}$	4. $25\frac{1}{8}$	5. $32\frac{1}{6}$	6. $24\frac{5}{9}$	7. $45\frac{5}{12}$
	$2\frac{2}{3}$	$4\frac{3}{4}$	$2\frac{4}{5}$	$13\frac{7}{8}$	$14\frac{5}{6}$	$17\frac{8}{9}$	$27\frac{7}{12}$

F.	1. $\frac{3}{4}$	2. $\frac{5}{6}$	3. $\frac{7}{8}$	4. $\frac{1}{2}$	5. $\frac{7}{16}$	6. $\frac{5}{6}$	7. $\frac{2}{3}$	8. $\frac{3}{4}$	9. $\frac{11}{15}$
	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{7}{12}$	$\frac{2}{5}$

10. $8\frac{1}{2}$	11. $19\frac{7}{8}$	12. $17\frac{1}{3}$	13. $34\frac{11}{16}$	14. $28\frac{2}{3}$	15. $27\frac{11}{12}$	16. $25\frac{11}{12}$
$2\frac{3}{4}$	$12\frac{3}{4}$	$3\frac{1}{6}$	$7\frac{5}{8}$	$13\frac{1}{6}$	$19\frac{1}{6}$	$18\frac{2}{3}$

Subtract, reducing answers:

G.	1.	2.	3.	4.	5.	6.	7.
	$28\frac{1}{4}$	$39\frac{1}{6}$	$27\frac{1}{8}$	$42\frac{2}{5}$	$34\frac{2}{9}$	$64\frac{1}{12}$	$47\frac{3}{8}$
	$14\frac{1}{2}$	$5\frac{1}{3}$	$15\frac{1}{4}$	$7\frac{7}{15}$	$8\frac{2}{3}$	$9\frac{5}{6}$	$19\frac{7}{16}$

H.	1.	2.	3.	4.	5.	6.	7.	8.	9.
	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{4}{5}$	$\frac{7}{8}$	$18\frac{1}{4}$	$22\frac{5}{6}$	$54\frac{2}{5}$	$43\frac{3}{4}$
	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{1}{3}$	$7\frac{1}{6}$	$8\frac{3}{8}$	$18\frac{1}{3}$	$27\frac{1}{3}$

I.	1.	2.	3.	4.	5.	6.	7.
	$49\frac{1}{3}$	$27\frac{1}{4}$	$48\frac{1}{5}$	$22\frac{1}{5}$	$46\frac{1}{3}$	$37\frac{1}{4}$	$45\frac{1}{12}$
	$21\frac{1}{2}$	$13\frac{1}{3}$	$12\frac{1}{3}$	$8\frac{1}{2}$	$17\frac{3}{8}$	$9\frac{5}{6}$	$16\frac{5}{8}$

J.	1.	2.	3.	4.	5.	6.
	$5.00	$10.00	$20.00	$40.00	$50.00	$100.00
	4.22	1.07	13.72	14.98	27.09	78.44

Find answers:

K.

1. $25 − $3.24 = ?
2. $30 − $5.25 = ?
3. $10 − $1.38 = ?
4. $20 − $4.85 = ?
5. $60 − $0.92 = ?
6. $5 − 38¢ = ?
7. $6 − 72¢ = ?
8. $4 − 12½¢ = ?
9. $3 − 37½¢ = ?
10. $7 − 6¼¢ = ?
11. $.45 − 7½¢ = ?
12. $.80 − 6¼¢ = ?
13. $.30 − 3¾¢ = ?
14. $.19 − 4 mills = ?
15. $.06¼ − 3½ mills = ?

L.

1. .962 − .243 = ?
2. 8.62 − 3.98 = ?
3. 4.823 − 2.78 = ?
4. 37.624 − 8.8 = ?
5. 214.71 − 32.9 = ?

M.

1. 24.8 − 1.24 = ?
2. 5.72 − .142 = ?
3. 32.7 − .364 = ?
4. 47 − .134 = ?
5. .85 − .3275 = ?
6. 6 − 3.4 = ?
7. 9 − 6.22 = ?
8. 4 − 1.142 = ?
9. 7 − .123 = ?

N.

1. $28\frac{3}{4} - 12.4 = ?$
2. $17\frac{4}{5} - 6.5 = ?$
3. $6.44 - 2\frac{1}{4} = ?$
4. $42.62 - 21\frac{3}{4} = ?$
5. $24.48 - 12.2\frac{1}{2} = ?$
6. $68.125 - 31.4\frac{1}{5} = ?$
7. $8.45 - .9\frac{1}{2} = ?$
8. $.724 - .3\frac{1}{4} = ?$
9. $8.4 - 5\frac{1}{4} = ?$
10. $7.24 - 3\frac{1}{8} = ?$
11. $6.7 - 2\frac{3}{8} = ?$
12. $9.4 - 1.2\frac{1}{2} = ?$
13. $8.64 - 4.1\frac{3}{4} = ?$
14. $.175 - .02\frac{1}{4} = ?$
15. $.96 - .3\frac{1}{8} = ?$

III. MULTIPLICATION

Find products. Before timing an exercise, copy the problems in it in form for work.

A. I. 55 to 65 sec.

1. 1479 × 4.
2. 2167 × 5.
3. 1894 × 7.
4. 7209 × 8.
5. 5438 × 6.
6. 5289 × 9.

B. I. 4 to $5\frac{1}{2}$ min.

1. 5249 × 42.
2. 1394 × 67.
3. 4629 × 86.
4. 9604 × 75.
5. 1632 × 49.
6. 7485 × 83.

C. I. 4 to 6 min.

1. 2134 × 201.
2. 1812 × 304.
3. 3452 × 209.
4. 1470 × 508.
5. 6091 × 706.
6. 1876 × 807.

A. II. 40 to 50 sec.

1. 904 × 80.
2. 128 × 70.
3. 317 × 90.
4. 674 × 300.
5. 628 × 600.
6. 825 × 800.

B. II. 6 to $7\frac{1}{2}$ min.

1. 1213 × 221.
2. 2279 × 435.
3. 3476 × 149.
4. 1807 × 617
5. 5128 × 358.
6. 4239 × 387.

C. II. $5\frac{1}{2}$ to $7\frac{1}{2}$ min.

1. 6124 × 1002.
2. 1423 × 7004.
3. 8072 × 6050.
4. 3216 × 3070.
5. 2743 × 3008.
6. 6504 × 5009.

Multiply, writing as few figures as possible:

D.
1. $620 \times \frac{1}{2}$.
2. $72 \times \frac{3}{8}$.
3. $540 \times \frac{5}{6}$.
4. $350 \times \frac{3}{4}$.
5. $96 \times \frac{4}{5}$.
6. $175 \times \frac{2}{3}$.

E.
1. $\frac{3}{4} \times 240$.
2. $\frac{5}{6} \times 300$.
3. $\frac{7}{8} \times 488$.
4. $\frac{2}{5} \times 64$.
5. $\frac{4}{7} \times 250$.
6. $\frac{4}{9} \times 375$.

F.
1. $\begin{array}{r} 21\frac{1}{2} \\ 6 \\ \hline \end{array}$
2. $\begin{array}{r} 42\frac{3}{4} \\ 8 \\ \hline \end{array}$
3. $\begin{array}{r} 21\frac{2}{3} \\ 9 \\ \hline \end{array}$
4. $\begin{array}{r} 25\frac{1}{4} \\ 5 \\ \hline \end{array}$
5. $\begin{array}{r} 34\frac{2}{3} \\ 7 \\ \hline \end{array}$
6. $\begin{array}{r} 61\frac{5}{8} \\ 6 \\ \hline \end{array}$
7. $\begin{array}{r} 42\frac{5}{6} \\ 9 \\ \hline \end{array}$

G. 1. $\begin{array}{r}12\\3\frac{1}{4}\\\hline\end{array}$ 2. $\begin{array}{r}45\\2\frac{1}{5}\\\hline\end{array}$ 3. $\begin{array}{r}28\\1\frac{3}{4}\\\hline\end{array}$ 4. $\begin{array}{r}36\\2\frac{5}{6}\\\hline\end{array}$ 5. $\begin{array}{r}16\\3\frac{1}{5}\\\hline\end{array}$ 6. $\begin{array}{r}25\\2\frac{1}{8}\\\hline\end{array}$ 7. $\begin{array}{r}17\\3\frac{2}{3}\\\hline\end{array}$

H. 1. $\begin{array}{r}31\frac{1}{5}\\25\\\hline\end{array}$ 2. $\begin{array}{r}42\frac{5}{8}\\24\\\hline\end{array}$ 3. $\begin{array}{r}24\\21\frac{1}{2}\\\hline\end{array}$ 4. $\begin{array}{r}18\\13\frac{1}{3}\\\hline\end{array}$ 5. $\begin{array}{r}60\\41\frac{3}{8}\\\hline\end{array}$ 6. $\begin{array}{r}57\\14\frac{2}{3}\\\hline\end{array}$ 7. $\begin{array}{r}75\\16\frac{7}{8}\\\hline\end{array}$

Find products:

I.

1. $\frac{1}{2} \times \frac{3}{4}$.
2. $\frac{2}{3} \times \frac{4}{5}$.
3. $\frac{3}{4} \times \frac{5}{8}$.
4. $\frac{1}{3} \times \frac{3}{4}$.
5. $\frac{3}{4} \times \frac{11}{12}$.
6. $\frac{3}{8} \times \frac{4}{9}$.
7. $\frac{8}{11} \times \frac{5}{6}$.
8. $\frac{9}{16} \times \frac{14}{15}$.
9. $\frac{11}{16} \times \frac{5}{12}$.
10. $\frac{15}{32} \times \frac{5}{16}$.

J.

1. $1\frac{2}{5} \times \frac{1}{7}$.
2. $\frac{1}{3} \times 2\frac{5}{8}$.
3. $\frac{3}{4} \times 2\frac{2}{3}$.
4. $\frac{4}{5} \times 1\frac{1}{4}$.
5. $\frac{2}{3} \times 3\frac{2}{3}$.
6. $1\frac{8}{7} \times 2\frac{1}{2}$.
7. $2\frac{2}{5} \times 3\frac{3}{4}$.
8. $4\frac{1}{2} \times 2\frac{1}{4}$.
9. $6\frac{2}{5} \times 2\frac{1}{3}$.
10. $5\frac{1}{8} \times 4\frac{1}{6}$.

K.

1. 274 × .8.
2. 326 × .04.
3. 784 × .023.
4. .425 × 6.
5. .875 × 20.
6. 3.82 × 34.
7. 1.625 × 213.
8. .84 × .3.
9. 42.18 × 3.05.
10. .8125 × 21.8.

L.

1. .017 × 3.
2. .0021 × 6.
3. .0042 × 24.
4. .14 × 6.
5. .28 × .03.
6. .023 × .04.
7. 3.215 × .004.
8. .875 × .014.
9. $1.53 \times .01\frac{1}{3}$.
10. $.192 \times .02\frac{2}{3}$.

M.I.

1. $8.22 \times .3\frac{1}{2}$.
2. $32.75 \times .6\frac{1}{5}$.
3. $44.38 \times .14\frac{2}{5}$.
4. $17.8\frac{1}{2} \times .04$.
5. $7.2\frac{3}{4} \times .25$.
6. $22\frac{3}{8} \times 1.23$.
7. $21\frac{1}{2} \times 14.5$.
8. $13\frac{3}{4} \times 22.5$.
9. $118\frac{2}{5} \times 2.3\frac{1}{4}$.
10. $214\frac{1}{8} \times 6.1\frac{3}{4}$.

M.II.

1. $40.75 \times .03\frac{1}{2}$.
2. $200.25 \times .04\frac{1}{2}$.
3. $540.80 \times .04\frac{3}{4}$
4. $720.25 \times .05\frac{1}{4}$.
5. $1.16\frac{1}{2} \times .2\frac{1}{5}$.
6. $.08\frac{1}{2} \times 2\frac{2}{5}$.
7. $7\frac{1}{8} \times .04\frac{4}{5}$.
8. $175\frac{1}{4} \times 8\frac{1}{3}$.
9. $225\frac{1}{8} \times .06\frac{2}{3}$.
10. $38\frac{3}{8} \times .021\frac{5}{6}$.

IV. Division

Find quotients. Before timing exercises A, B, C, or D, copy the problems in it in form for work.

A. $1\frac{1}{4}$ to 2 min.

1. $13888 \div 4$.
2. $39930 \div 5$.
3. $24288 \div 6$.
4. $29965 \div 7$.
5. $57883 \div 8$.
6. $95174 \div 9$.

B. $2\frac{1}{2}$ to $3\frac{1}{2}$ min.

1. $22791 \div 71$.
2. $35265 \div 82$.
3. $31756 \div 63$.
4. $676800 \div 940$.
5. $422010 \div 521$.
6. $3036960 \div 432$.

C. $4\frac{1}{2}$ to 8 min.

1. $35297 \div 47$.
2. $56236 \div 68$.
3. $210678 \div 39$.
4. $507000 \div 78$.
5. $64152 \div 891$.
6. $308880 \div 572$.

D.I. $7\frac{1}{2}$ to $10\frac{1}{2}$ min.

1. $14250 \div 75$.
2. $18176 \div 64$.
3. $32868 \div 83$.
4. $461760 \div 96$.
5. $42897 \div 543$.
6. $293760 \div 432$.

D.II. $7\frac{1}{2}$ to $10\frac{1}{2}$ min.

1. $12714 \div 26$.
2. $63200 \div 16$.
3. $24732 \div 36$.
4. $51884 \div 68$.
5. $27232 \div 46$.
6. $37730 \div 77$.

D.III. 8 to $11\frac{1}{2}$ min.

1. $39330 \div 570$.
2. $50568 \div 172$.
3. $693500 \div 146$.
4. $147750 \div 1970$.
5. $280800 \div 7800$.
6. $2305500 \div 2650$.

E.

1. $3 \div \frac{1}{4}$.
2. $6 \div \frac{3}{4}$.
3. $8 \div \frac{6}{7}$.
4. $40 \div \frac{3}{8}$.
5. $25 \div \frac{4}{7}$.
6. $148 \div \frac{3}{5}$.
7. $96 \div \frac{15}{16}$.
8. $125 \div \frac{19}{24}$.

F.

1. $\frac{3}{4} \div \frac{1}{2}$.
2. $\frac{7}{8} \div \frac{3}{4}$.
3. $\frac{5}{16} \div \frac{5}{8}$.
4. $\frac{5}{6} \div \frac{5}{12}$.
5. $\frac{15}{16} \div \frac{3}{4}$.
6. $\frac{5}{6} \div \frac{7}{8}$.
7. $\frac{11}{12} \div \frac{5}{8}$.
8. $\frac{15}{16} \div \frac{4}{5}$.

G.

1. $\frac{2}{3} \div 3$.
2. $\frac{4}{5} \div 2$.
3. $\frac{8}{9} \div 6$.
4. $\frac{10}{11} \div 4$.
5. $\frac{6}{7} \div 8$.
6. $\frac{5}{6} \div 12$.
7. $\frac{15}{16} \div 20$.
8. $\frac{5}{8} \div 16$.

H.

1. $6 \div 1\frac{1}{2}$.
2. $20 \div 3\frac{1}{3}$.
3. $21 \div 4\frac{2}{3}$.
4. $16 \div 1\frac{4}{5}$.
5. $2\frac{5}{8} \div 3$.
6. $12\frac{1}{2} \div 2$.
7. $9\frac{3}{4} \div 8$.
8. $12\frac{1}{2} \div \frac{5}{6}$.
9. $1\frac{7}{8} \div \frac{5}{12}$.
10. $23\frac{1}{8} \div \frac{4}{5}$.
11. $14\frac{3}{5} \div \frac{4}{7}$.
12. $30\frac{5}{9} \div \frac{11}{12}$.

I.

1. $2\frac{2}{3} \div 1\frac{2}{3}$.
2. $3\frac{3}{4} \div 1\frac{3}{7}$.
3. $19\frac{1}{2} \div 6\frac{1}{4}$.
4. $7\frac{1}{2} \div 2\frac{1}{2}$.
5. $1\frac{7}{8} \div 1\frac{9}{16}$.
6. $4\frac{2}{3} \div 7\frac{1}{3}$.
7. $3\frac{3}{4} \div 1\frac{7}{8}$.
8. $2\frac{1}{2} \div 1\frac{1}{5}$.
9. $4\frac{1}{2} \div 1\frac{2}{3}$.
10. $8\frac{1}{2} \div 2\frac{1}{3}$.
11. $5\frac{2}{3} \div 1\frac{1}{8}$.
12. $102\frac{4}{5} \div 1\frac{1}{3}$.

Do work indicated:

J.

1. 267.5 ÷ 5.
2. 1.641 ÷ 3.
3. .047 ÷ 2.
4. 68.16 ÷ 32.
5. 9.775 ÷ 25.
6. 4.032 ÷ 72.
7. 159.25 ÷ 245.
8. 16.082 ÷ 374.

K.

1. 8.754 ÷ .2.
2. .0252 ÷ .4.
3. .725 ÷ .05.
4. 47.932 ÷ 9.2.
5. 2.597 ÷ 3.5.
6. .0966 ÷ .42.
7. .0875 ÷ .625
8. 3.4608 ÷ 82.4.

L.

1. 74.4 ÷ .3.
2. 9762.5 ÷ .5.
3. 975.48 ÷ .04.
4. 75.968 ÷ .002.
5. 302.4 ÷ 8.4.
6. 333.36 ÷ .72.
7. 1017.55 ÷ 4.33.
8. 117.375 ÷ 4.125.

M.I.

1. 97.2 ÷ .06.
2. 796.4 ÷ .005.
3. 678.4 ÷ .32.
4. 102.7 ÷ .065.
5. 22.25 ÷ .052
6. 9693.2 ÷ 4.22.
7. 6.25 ÷ .375.
8. 27.37 ÷ .0425.

M.II.

1. 7965 ÷ .3.
2. 524 ÷ .02.
3. 1575 ÷ .007.
4. 828 ÷ .72.
5. 75 ÷ .125.
6. 528 ÷ 2.4.
7. 250 ÷ 6.25.
8. 4725 ÷ .225.

N.

1. 7284 ÷ 100.
2. 965 ÷ 500.
3. 482 ÷ 1000.
4. 684 ÷ 2000.
5. 747 ÷ 3000.
6. 976 ÷ 4000.
7. 165 ÷ 5000.
8. 97 ÷ 8000.

O.

1. $6.72 \div 3\frac{1}{5}$.
2. $1.464 \div 2\frac{2}{5}$.
3. $131\frac{3}{4} \div 77\frac{1}{2}$.
4. $153\frac{3}{4} \div 1\frac{1}{4}$.
5. $492.8 \div 4\frac{2}{5}$.
6. $336 \div .1\frac{3}{5}$.
7. $253 \div 5\frac{3}{4}$.
8. $401.7 \div 7.7\frac{1}{4}$.

9. $\dfrac{560 \times .04\frac{3}{4}}{2} = ?$

10. $\dfrac{950.75 \times .03\frac{1}{2}}{12} = ?$

11. $\dfrac{7200 \times 19 \times .05\frac{1}{2}}{360} = ?$

12. $\dfrac{671\frac{4}{5} - 214\frac{1}{2}}{3.4} = ?$

13. $\dfrac{745\frac{3}{8} - 154.25\frac{1}{2}}{4.8} = ?$

14. $\dfrac{(3 \times 24.5) + 36\frac{1}{2}}{4\frac{2}{5}} = ?$

15. $1500 - \dfrac{1500 \times .04\frac{1}{2}}{4} = ?$

16. $750 - \dfrac{750 \times .04\frac{3}{4} \times 90}{360} = ?$

TABLES

LENGTH

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
5½ yards, or 16½ feet = 1 rod (rd.)
320 rods, or 5280 feet = 1 mile (mi.)

A **hand** = 4 in.; sometimes used in measuring the height of a horse.
A **fathom** = 6 ft.; used in measuring depth of water.
A **knot** = 1.15 mi.; used in measuring distances at sea.

SURFACE

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

A **section** = 1 square mile.
A **square** = 100 square feet (of roof or pavement).

VOLUME

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

A **cord** of wood = 128 cu. ft. It is usually a pile 8 ft. long, 4 ft. wide, and 4 ft. high.

A **load of earth** = 1 cu. yd. (approximately).

AVOIRDUPOIS WEIGHT

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

A **hundredweight** (cwt.) = 100 lb.

A **long ton** = 2240 lb.; used sometimes for material in which there is much waste, such as ores from mines.

LIQUID MEASURE

4 gills (gi.) = 1 pint (pt.)

2 pints = 1 quart (qt.)

4 quarts = 1 gallon (gal.)

A **barrel** (bbl.) = 31½ gal.

A **hogshead** = 63 gal.

1 **gal.** = 231 cu. in.

A **gallon of water** weighs about 8⅓ lb.

A **cubic foot of water** weighs about 62½ lb.

DRY MEASURE

2 pints (pt.) = 1 quart (qt.)

8 quarts = 1 peck (pk.)

4 pecks = 1 bushel (bu.)

A **bushel** contains 2150.42 cu. in., or about 1¼ cu. ft.

TIME

60 seconds (sec.) = 1 minute (min.)

60 minutes = 1 hour (hr.)

24 hours = 1 day (da.)

7 days = 1 week (wk.)

365 days = 1 common year (yr.)

366 days = 1 leap year

Months having 31 days: Jan., Mar., May, July, Aug., Oct., Dec.

Months having 30 days: Apr., June, Sept., Nov.

A **solar year** = 365 da. 5 hr. 48 min. 46 sec., or 365¼ da.

A **leap year** = a centennial year divisible by 400 or any other year divisible by 4.

A **decade** = 10 yr.

A **century** = 100 yr.

ANGLES AND ARCS

60 seconds (″) = 1 minute (′)

60 minutes = 1 degree (°)

360 degrees = 1 circumference

A **right angle** = 90°.

An **acute angle** is less than 90°.

An **obtuse angle** is greater than 90°

COUNTING

12 units = 1 dozen (doz.)

12 dozen = 1 gross

12 gross = 1 great gross

A **score** is 20 things.

PAPER

24 sheets = 1 quire
20 quires = 1 ream

MONEY

UNITED STATES AND CANADA

10 mills = 1 cent (¢)
10 cents = 1 dime
10 dimes = 1 dollar ($)

BRITISH ISLES

4 farthings (far.) = 1 penny (d.)
12 pence = 1 shilling (s.)
20 shillings = 1 pound sterling (£)

GERMANY

100 pfennig (pf.) = 1 mark (M.)

FRANCE

100 centimes (c.) = 1 franc (fr.)

STANDARD VALUES OF FOREIGN COINS IN UNITED STATES MONEY

COUNTRY	COIN	VALUE IN U. S. MONEY
Argent. R.	Peso	$0.965
Austria-H.	Crown	.203
Belgium	Franc	.193
Bolivia	Boliviano	.389
Brazil	Milreis	.546
Canada	Dollar	1.00
Cent. Am.	Peso	.435
Chile	Peso	.365
China	Tael: Shanghai	.651
	Tael: Haikwan	.726
	Tael: Canton	.711
Colombia	Dollar	1.00
Costa Rica	Colon	.465
Denmark	Crown	.268
Ecuador	Sucre	.487
Egypt	Pound (100 piasters)	4.943
France	Franc	.193
Germany	Mark	.238
Gt. Britain	Pound sterling	4.866
Greece	Drachma	.193
Hayti	Gourde	.965
India	Rupee	$0.324
Italy	Lira	.193
Japan	Yen	.498
Mexico	Peso	.498
Netherlands	Florin	.402
Newfoundl'd	Dollar	1.014
Norway	Crown	.268
Panama	Balboa	1.00
Peru	Libra	4.866½
Portugal	Milreis	1.08
Russia	Ruble	.515
Spain	Peseta	.193
Sweden	Crown	.268
Switzerland	Franc	.193
Turkey	Piaster	.044
Uruguay	Peso	1.034
Venezuela	Bolivar	.193

METRIC SYSTEM

LENGTH

10 millimeters (mm.) = 1 centimeter (cm.)
10 centimeters = 1 decimeter (dm.)
10 decimeters = 1 meter (m.)
10 meters = 1 dekameter (Dm.)
10 dekameters = 1 hektometer (Hm.)
10 hektometers = 1 kilometer (Km.)
10 kilometers = 1 myriameter (Mm.)

SURFACE

100 square millimeters (sq. mm.) = 1 square centimeter (sq. cm.)
100 square centimeters = 1 square decimeter (sq. dm.)
100 square decimeters = 1 square meter (sq. m.)
100 square meters = 1 square dekameter (sq. Dm.)
100 square dekameters = 1 square hektometer (sq. Hm.)
100 square hektometers = 1 square kilometer (sq. Km.)

LAND

100 square decimeters = 1 centare (ca.)
100 centares = 1 are (a.)
100 ares = 1 hektare (Ha.)

VOLUME

1000 cubic millimeters (cu. mm.) = 1 cubic centimeter (cu. cm.)
1000 cubic centimeters = 1 cubic decimeter (cu. dm.)
1000 cubic decimeters = 1 cubic meter (cu. m.)

WOOD

10 decisteres (ds.) = 1 stere
10 steres = 1 dekastere

CAPACITY

10 milliliters (ml.) = 1 centiliter (cl.)
10 centiliters = 1 deciliter (dl.)
10 deciliters = 1 liter (l.)
10 liters = 1 dekaliter (Dl.)
10 dekaliters = 1 hektoliter (Hl.)
10 hektoliters = 1 kiloliter (Kl.)

WEIGHT

10 milligrams (mg.) = 1 centigram (cg.)
10 centigrams = 1 decigram (dg.)
10 decigrams = 1 gram (g.)
10 grams = 1 dekagram (Dg.)
10 dekagrams = 1 hektogram (Hg.)
10 hektograms = 1 kilogram (Kg.)
10 kilograms = 1 myriagram (Mg.)
10 myriagrams = 1 quintal (Q.)
10 quintals = 1 metric ton (M.T.)

EQUIVALENTS OF METRIC MEASURES

METRIC METRIC
1 liter = 1 cu. dm.
1 gram = weight of 1 cu. cm. of water.
1 are = 1 sq. Dm.
1 stere = 1 cu. m.

METRIC ENGLISH
1 m. = 39.37 in.
1 Km. = .62137 mi.
1 sq. m. = 1.196 sq. yd.
1 Ha. = 2.471 A.
1 cu. m. = 1.308 cu. yd.
1 l. = { .908 qt. (dry) / 1.0567 qt. (liq.)
1 Hl. = 2.8377 bu.
1 Kg. = 2.2046 lb.
1 M.T. = 1.1023 T.

ENGLISH METRIC
1 yd. = .9144 m.
1 mi. = 1.60935 Km.
1 sq. yd. = .836 sq. m.
1 A. = .4047 Ha.
1 cu. yd. = .765 cu. m.
1 qt. (dry) = 1.1012 l.
1 qt. (liq.) = .94636 l.
1 bu. = .35239 Hl.
1 lb. (av.) = .45359 Kg.
1 T. = .90718 M. T.

MINIMUM WEIGHTS OF PRODUCE

According to the laws of the United States:

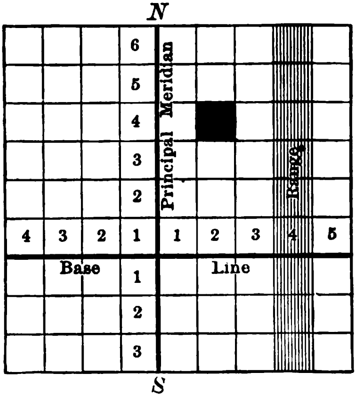
	Per Bushel		Per Bushel
Wheat	60 lb.	White Beans	60 lb.
Corn, in the ear	70 „	Castor Beans	46 „
Corn, shelled	56 „	White Potatoes	60 „
Rye	56 „	Sweet Potatoes	55 „
Barley	48 „	Onions	57 „
Oats	32 „	Turnips	55 „
Peas	60 „	Dried Apples	26 „

MINIMUM WEIGHTS OF PRODUCE (continued)

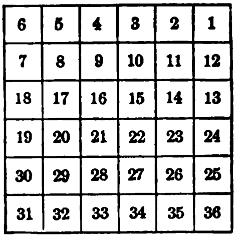
Clover Seed	60 lb.	Hemp Seed	44 lb.
Millet Seed	50 "	Corn Meal	48 "
Timothy Seed	45 "	Malt	34 "
Blue Grass Seed	44 "	Bran	20 "

GOVERNMENT LANDS

640 acres = 1 section (= 1 sq. mi.)
36 sections = 1 township.

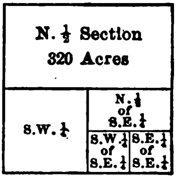


Land Laid Out in Townships



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

A Township



A Section

Government lands are usually laid out by surveyors in townships 6 miles square, each township containing 36 sections. A section is a square mile.

The surveyor first selects a north and south line, called the *principal meridian*, and a *base line* intersecting it at some point. *Range lines* are then laid off east and west of the principal meridian at distances of 6 miles. The strips of land 6 miles wide thus formed are called **ranges**. Similarly, lines are laid off north and south of the base line at distances of 6 miles, thus dividing the ranges into **townships**.

The ranges are numbered east and west from the principal meridian; and the townships, north and south from the base line. Thus, the township indicated by the black square would be designated "Township 4 North, Range 2 East."

Each section is also divided into fractional parts and so designated, as shown in the diagram.

DEFINITIONS[1]

Abstract number. An abstract number is one that does not refer to an object or a unit of measure.

Account. An account is a statement, in standard form, of credit and debit items.

Acute angle. An acute angle is an angle that is less than a right angle.

Addend. An addend is a number combined with one or more other numbers to form a sum.

Addition. Addition is the process of finding the sum of two or more numbers.

Algebraic equation. An algebraic equation is an equation containing one or more unknown quantities. See *Equation.*

Aliquot part. An aliquot part is a number which, when used as a divisor of the number of which it is a part, gives an integer as a quotient. Example: 12½ is an aliquot part of 100.

Altitude. The altitude of a figure or an object is its perpendicular height.

Amount. (*a*) In percentage, the amount is the sum of the base and the percentage. (*b*) In interest, the amount is the sum of the principal and the interest.

Angle. An angle is the amount of divergence of two straight lines meeting at a point.

Approximation. An approximation is a result that approaches correctness, but is not computed exactly.

Arc. An arc is a part of the circumference of a circle.

Area. Area is the number of square units contained in a surface.

Arithmetic. Arithmetic is the science that treats of numbers and their use.

Average. An average is a result found by dividing a number of unequal quantities into the same number of equal parts.

Bank discount. Bank discount is the interest on the face of a note, deducted in advance by a bank purchasing the note.

Bank draft. A bank draft is a bank's written order directing another bank to pay a specified sum of money.

Base. In percentage, the base is the number of which a per cent is taken.

Bill. A bill is a statement, in standard form, of charges of goods purchased or services rendered, or of other forms of indebtedness.

Bill of exchange. A bill of exchange is a draft on a bank in another city.

Bond. A bond is a contract in which a government, municipality, or corporation agrees to pay a specified sum of money at a definite future date, and, until this date, to pay at regular intervals a fixed rate of interest on the face value of the bond.

Brokerage. Brokerage is the commission charged by a broker for buying or selling stocks or bonds.

Cancellation. Cancellation is the process of striking out a common factor where a division is indicated.

Capital. Capital is the amount of money invested in a business enterprise.

Check (bank). A bank check is a written order on a bank to pay a specified sum of money.

Circle. A circle is a plane figure bounded by a curved line, every point of which is equally distant from a point within called the center.

Circumference. A circumference is the boundary of a circle.

Collateral note. A collateral note is a form of promissory note which is secured by the deposit of a mortgage or other evidence of property.

Commercial draft. A commercial draft is a draft made by one person on another person to obtain money owed.

Commission. A commission is a percentage paid an agent for work done.

Common denominator. A common denominator is a number that is used as the denominator of two or more fractions.

Common factor. A common factor is a factor common to a group of numbers.

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[1] Although the authors have endeavored to give definitions that are accurate, they have kept in mind the need of simplicity of statement, in order that the definitions may be within the comprehension of pupils. Only the aspects of subjects covered in these books are included in the definitions.

Common fraction. A common fraction is a fraction written with both numerator and denominator expressed.

Common interest. Common interest is interest computed on the basis of 30 days to the month and 360 days to the year.

Common multiple. A common multiple of two or more numbers is a number that is divisible by each of the numbers. Example: 30 is a common multiple of 10 and 15.

Common stock. Common stock is stock in a corporation that may receive a proportional share of the profits, after all indebtedness, including a dividend on any preferred stock, has been paid.

Complex fraction. A complex fraction is a fraction having for its numerator or denominator, or for both, a fraction or a mixed number.

Compound interest. Compound interest is interest computed upon both the principal and the accrued interest.

Compound number. A compound number is a number expressed in two or more denominations. Example: 4 ft. 2 in.

Concrete number. A concrete number is one that refers to a particular kind of object or measure. Examples: 4 books; 12 miles.

Cone. A cone is a solid having a circle as a base and a convex surface tapering uniformly to a point. It is the solid that may be thought of as cut out when a right-angled triangle is rotated about one of its sides as an axis.

Contract. A contract is a formal agreement to do a specified thing for a stated consideration.

Corporation. A corporation is a group of individuals organized by law to carry on a certain kind of business.

Credit. (*a*) To credit an account is to deduct from the charges, or debit items, a stated sum received. (*b*) A credit is an item credited to an account.

Creditor. A creditor is a person to whom money is owed.

Custom duty. Same as import duty.

Cylinder. A cylinder is the solid that may be thought of as cut out when a rectangle is rotated about one of its sides as an axis.

Debit. (*a*) To debit an account is to add an item of indebtedness to an account. (*b*) A debit is an item debited to an account.

Debtor. A debtor is a person who owes money.

Decimal. A decimal is a fraction having a denominator of ten or a power of ten, which is indicated but not expressed.

Decimal system. A decimal system is a system based upon the number ten.

Demand note. A demand note is a promissory note that must be paid when requested by the holder.

Denominate number. A denominate number is one that refers to a unit of measure. Example: 4 lb.

Denominator. The denominator of a fraction is the number that shows into how many equal parts a unit has been divided.

Diameter of a circle. A diameter of a circle is a straight line drawn through the center of the circle to opposite points in its circumference.

Difference or remainder. A difference or remainder is a result found by subtraction.

Discount. A discount is a percentage deducted from the marked or list price of goods to be sold, or from a note.

Dividend. (*a*) A dividend is a number to be divided. (*b*) A dividend is a sum paid on each share of stock from the profits of a corporation.

Division. Division is the process of finding how many times one number is contained in another.

Divisor. A divisor is a number by which another number is divided.

Draft. A draft is a written order directing one person to pay another person a specified sum of money.

Endowment policy. An endowment policy is an insurance policy covering a given term of years, and providing that at the end of the time, if the person insured is still living, the face of the policy is to be paid to him; and that if he dies during the period, the face of the policy is to be paid to his heirs.

Equation. An equation is the expression of equality between two quantities.

Equilateral triangle. An equilateral triangle is a triangle with its three sides equal.

Even number. An even number is a number divisible by two.

Exact interest. Exact interest is interest computed for the exact number of days in the term of interest.

Exchange. Exchange is a statement of the relative value of money in two places.

Express order. An express order is a money order issued by an express company.

Extremes. The extremes of a proportion are the two outside terms.

Face of a policy. The face of a policy is the amount of insurance named in an insurance policy to be paid in case of loss.

Factors. The factors of a number are those numbers which, when multiplied together, give the number.

Foreign bill of exchange. A foreign bill of exchange is a draft on a bank in a foreign country.

Fraction. A fraction is (*a*) one or more of the equal parts of a unit; (*b*) the expression in fractional form of the ratio of one number to another.

Graph. A graph is a diagram picturing the relation among numbers or numerical facts.

Gross profit. The gross profit is the difference between the receipts and the expenses, not including overhead charges.

Hexagon. A hexagon is a plane figure bounded by six straight lines.

Horizontal line. A horizontal line is a line parallel to the surface of still water.

Hypotenuse. The hypotenuse is the longest side of a right-angled triangle.

Import duty. An import duty is a tax, or tariff, levied by act of Congress on goods imported from other countries.

Improper fraction. An improper fraction is one that is equal to or greater than a unit. Examples: $\frac{2}{2}$, $\frac{3}{2}$.

Income from an investment. The income from an investment is the amount of profit received from it.

Indorse. To indorse a check, note, or draft is to write, or stamp, one's name across the back of it.

Insurance. Insurance is a sum of money to be paid by a company in case of loss.

Integer. An integer is a whole number.

Interest. Interest is money paid for the use of money.

Interest-bearing note. An interest-bearing note is a promissory note on which interest must be paid.

Internal revenue. Internal revenue is a tax collected by the Government on incomes or on certain goods manufactured within the country.

Inventory. An inventory is a list of goods with their valuation.

Invoice. An invoice is an itemized statement of goods bought.

Isosceles triangle. An isosceles triangle is a triangle with two of its sides equal.

Kilowatt. A kilowatt, the unit used in measuring electrical current, is equivalent to a thousand watts.

Least common multiple. The least common multiple of two or more numbers is the smallest number that is exactly divisible by each of the group. Example: 50 is the l.c.m. of 25, 10, and 2.

Like fractions. Like fractions are fractions having the same denominator.

Loss. Loss is the difference between the expenses and the receipts in a business when the expenses exceed the receipts.

Lowest terms. A fraction is in its lowest terms when the numerator and the denominator contain no common factor greater than one.

Maker. The maker of a check, draft, or note is the person who signs it.

Maturity. The date of maturity of a note is the date on which it becomes due and must be paid.

Means. The means of a proportion are the two middle terms.

Members of an equation. The members of an equation are the two quantities stated to be equal.

Meter. A meter, the basis of the metric system, is nearly one ten-millionth of the distance from the equator to either pole.

Metric system. The metric system is a decimal system of weights and measures based on the meter.

Minuend. A minuend is a number from which another number is subtracted.

Minus sign (−). The minus sign is the sign used to indicate subtraction.

Mixed number. A mixed number is an integer and a fraction written as one quantity.

Monthly statement. A monthly statement is a bill, sent usually at the first of the month, showing the amount charged against an account.

Mortgage. A mortgage is a written guarantee to pay indebtedness secured by the temporary transference to the loaner of the title to land or other property belonging to the borrower.

Multiple. A multiple of a number is the result obtained by taking the number a given number of times as a factor. Example: 15 is a multiple of 5.

Multiplicand. A multiplicand is a number to be multiplied.

Multiplication. Multiplication is the process of taking a number a given number of times.

Multiplier. A multiplier is a number that indicates how many times a multiplicand is to be taken.

Net price. A net price is the charge for goods after all deductions have been made.

Net proceeds. The net proceeds, or proceeds, is the balance after all discounts or charges have been deducted.

Net profit. Net profit is the difference between the total receipts and total expenses of a business when the receipts exceed the expenses.

Notation. A notation is a system of writing numbers.

Note. Same as promissory note.

Number. A number is that which answers the question, "How many?"

Numerator. A numerator of a fraction is the number that shows how many of the equal parts of a unit have been used to form the fraction.

Obtuse angle. An obtuse angle is an angle greater than a right angle.

Odd number. An odd number is a number that is not exactly divisible by two.

Parallel lines. Parallel lines are lines drawn in the same direction so that, no matter how far they might be extended, they would never meet.

Parallelogram. A parallelogram is a quadrilateral with its opposite sides parallel.

Par value. Par value is the face value of a share of stock or of a bond.

Payee. The payee of a check, draft, or note is the person to whom it is made payable.

Per cent. Per cent means by the hundred.

Percentage. (*a*) Percentage is the subject dealing with per cents. (*b*) A percentage is the result found by taking a given number of hundredths of a number.

Perimeter. The perimeter of a plane figure is its boundary line.

Period. A period in the Arabic notation is a group of figures that have the same denomination.

Perpendicular lines. Perpendicular lines are lines drawn at right angles to each other.

Pi. Pi (π) is the ratio of the circumference of a circle to the diameter.

Plus sign (+). The plus sign is the sign used to indicate addition.

Policy. A policy is a written contract guaranteeing the payment of insurance in case of a specified loss.

Poll tax. A poll tax is a tax levied upon individuals.

Polygon. A polygon is a plane surface bounded by three or more sides.

Postal money order. A postal money order, or postal order, is a written order to a post office to pay a specified sum of money.

Power. The power of a number is the product found by multiplying the number by itself a given number of times.

Preferred stock. Preferred stock is stock in a corporation that must receive a fixed rate of dividend before the common stock is entitled to a share of the profits.

Premium. A premium is a fee charged for insurance.

Prime number. A prime number is a number that is divisible by no number other than itself and one.

Principal. The principal is a sum of money upon which interest is computed.

Prism. A prism is a solid bounded by two opposite equal and parallel surfaces and by parallelograms.

Proceeds. Same as net proceeds.

Product. A product is the result found by taking a quantity a given number of times.

Profit. Profit is the amount of money made after the expenses have been paid.

Promissory note. A promissory note is a written promise to pay a specified sum of money at a stated time.

Proper fraction. A proper fraction is one that is less than a unit. Example: $\frac{3}{4}$.

Proportion. A proportion is the expression of the equality of two or more ratios.

Protractor. A protractor is an instrument used to measure angles.

Pyramid. A pyramid is a solid whose base is a polygon and whose sides are triangles terminating in a common point.

Quadrilateral. A quadrilateral is a plane figure bounded by four straight lines.

Quotient. A quotient is a result found by division.

Radii. Plural of radius.

Radius. A radius of a circle is a straight line drawn from the center of the circle to its circumference.

Rate of interest. The rate of interest is the per cent paid for the use of money.

Rate per cent. The rate per cent is the number of hundredths taken.

Ratio. Ratio is the relation between two numbers.

Real estate. Real estate is land and buildings.

Receipt. A receipt is a statement, in standard form, that a stated sum of money has been paid by one person to another person.

Reciprocal of a fraction. The reciprocal of a fraction is the fraction with its terms inverted.

Rectangle. A rectangle is a right-angled parallelogram.

Rectangular prism. A rectangular prism is a prism bounded by rectangular surfaces.

Reduction. Reduction is the process of changing the form of a number without changing its value.

Return on an investment. The return on an investment is the per cent found by dividing the annual net income by the amount of capital invested.

Right angle. A right angle is an angle of 90 degrees.

Right triangle. A right triangle is a triangle containing a right angle.

Round number. A round number is an approximation expressed by a number easily comprehended.

Salesman's slip or check. A salesman's slip or check is a form filled out by a sales clerk when a purchase is made.

Sector. A sector is part of a circle enclosed by two radii and an arc.

Share. A share is one of the equal parts into which the capital stock of a corporation is divided.

Similar triangles. Similar triangles are triangles whose corresponding sides have the same ratio.

Solid. A solid is anything that has length, breadth, and thickness.

Square. A square is a rectangle with its sides equal.

Square root. The square root of a number is the factor which, when multiplied by itself, gives the number.

Stockbroker. A stockbroker is a person whose business it is to buy and sell stocks and bonds on commission.

Stock certificate. A stock certificate is a document showing how many shares of stock have been purchased at one time.

Stock company. A stock company is a body of persons authorized by law to issue and sell stock in order to secure money for the purpose of carrying on a certain kind of business.

Stock exchange. A stock exchange is a market where stocks and bonds are bought and sold by brokers.

Stockholder. A stockholder is a person owning one or more shares of stock.

Straight angle. A straight angle is an angle of 180 degrees.

Subtraction. Subtraction is the process of finding the difference between two numbers.

Subtrahend. A subtrahend is a number subtracted from a minuend.

Sum. A sum is the result found by adding two or more numbers.

Term of insurance. A term of insurance is the period of time covered by an insurance policy.

Term of interest. A term of interest is the period of time during which a given sum of money bears interest.

Terms of a fraction. The terms of a fraction are its numerator and its denominator.

Terms of sale. The terms of sale are the conditions as to discount and time of settlement stated in an invoice or a bill.

Time note. A time note is a promissory note payable on a specified date.

Trapezoid. A trapezoid is a quadrilateral with only two sides parallel.

Triangle. A triangle is a plane figure bounded by three straight lines that meet to form three angles.

Unit. A unit is one thing, or a group of things taken as a whole.

Unlike fractions. Unlike fractions are fractions having different denominators.

Vertical line. A vertical line is a line perpendicular to a horizontal line and following the direction of a plumb line.

Volume. The volume or cubical contents of a solid is the number of cubical units contained in it.

Watt. A watt, used in measuring electrical current, is a thousandth part of a kilowatt.

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